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RATIONALE OF TREATMENT IN MAXILLOFACIAL INJURIES WITH REPORT OF FOUR CASES

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The dual purpose of this paper is to stress the necessity of adhering to a logical sequence of treatment factors in the successful management of complicated jaw injuries and to emphasize pertinent fundamentals of concern to the oral surgeon.

In hospital practice the handling of these cases is a mutual responsibility of various services, of which the dental, the plastic or orthopedic and neurosurgical services play the principal roles. It is of the utmost importance that the closest possible liaison exist between these services in the development of a rational plan of procedure. When a number of operations are involved in a case of maxillofacial reconstruction, these operations should be performed in a sequence conducive to the best end result. For example, it would be inadvisable to make a plastic repair on a collapsed jaw and thus render it more difficult for the oral surgeon to restore masticatory function. Conversely, it would be equally inadvisable to attempt immobilization of the jaws in the presence of severe systemic disorders requiring precedence in treatment.

Experience gained from World War I demonstrated the need for maxillofacial teams composed of various specialists working closely together to serve the best interests of the patient. Reports indicate that these teams, as

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used in the Services, have made a substantial contribution to improved treatment in World War II. However, it is believed that even better results are possible of attainment when the various specialists making up these teams have a broad understanding and some training in mutual fields of endeavor. The establishment of treatment centers, staffed by competent, cooperative maxillofacial teams, seems to be the solution to the problem of providing the best possible attention and care for the more complicated cases of face and jaw injuries.

The time of treatment for maxillofacial cases is frequently as important as the nature of the treatment rendered. Indeed, it may be said that favorable prognosis for these cases is dependent upon two factors: the time of treatment as well as the nature of the treatment. With the passage of time, if no treatment or simply symptomatic treatment is rendered, the prognosis becomes progressively more unfavorable. It is obvious that definitive treatment for these cases is considerably handicapped by the formation of cicatricial tissue, by bony consolidation in malunion and by the inception of avoidable infection.[1]

This paper will be divided into four parts with emphasis placed upon the oral surgeon's responsibilities at the time that maxillofacial cases come under his cognizance. For purposes of clarity and satisfactory continuity, the development of this theme will progress from the time of injury through the definitive phase of treatment. To avoid as much as possible an unnecessary review of the literature and to afford succinctness, pertinent accepted principles of treatment will be indicated with minimum elaboration so that greater emphasis may be brought to bear upon the dental phases of such treatment.

EMERGENCY TREATMENT

The emergency phase of treatment has as its primary objective the saving of life and is administered on the field of action or scene of the accident. Initially, it is necessary to determine that the patient is breathing. An unobstructed airway should be established immediately. Pharyngeal obstructions may be caused by foreign bodies, dental appliances, blood, mucus or collapsed anatomic structures. Displaced dental appliances may be removed by the use of the fingers or better yet by suitable forceps if the appliance has fallen back into the throat. Gauze sponges serve to free the pharynx of blood and mucus. A crushed lower jaw may be accompanied by the tongue and tissues of the floor of the mouth falling back into the oropharynx. In this event it is necessary to hold these tissues forward. Splints or devices applied at this time are temporary expedients used to place the injured parts in a state of rest, insure a free airway and maintain the tissues in as normal a relationship as the emergency situation will permit. A mechanical

1. Blair, Vilray P.: Relation of Early Care to Final Outcome of Major Face Wounds in War Surgery. Cincinnati J. Med. 24:121, May 1943.

airway, a metal or rubber tube, may be used to maintain patent air passages. A tracheal trocar inserted through the cricothyroid membrane is indicated in the event that more conservative measures are not efficacious. This procedure is warranted only as a lifesaving measure in view of the fact that high tracheotomy is commonly followed by chronic stenosis.[2]

Pressure bandages applied externally and pressure sponges placed intraorally will ordinarily control hemorrhage until more effective procedures may be accomplished. However, free bleeding from a larger vessel may require immediate ligation. It is well to keep in mind the carotid, external maxillary and temporal arterial pressure points. Shock is effectively combated by the use of morphine and parenteral fluids.[3, 4] The use of plasma in the Services has been responsible for saving many lives.

When patients are moved from the scene of action, more time and better facilities are available at a clearing station or base hospital for more comprehensive treatment. Greater attention may now be given to débridement, hemostasis and closure of facial wounds. Fibrin foam and thrombin, in which is incorporated a compatible chemotherapeutic agent such as penicillin, may be found to be beneficial in the early treatment of soft tissue defects. The advantages and disadvantages of primary versus delayed closure of maxillofacial wounds will not be dealt with in this paper. Suffice it to say that proper early care is a matter of keen surgical judgment and that such care has a marked influence on the functional and cosmetic end result.[5] Débridement of facial wounds necessitates utmost conservatism in the retention of all viable and potentially viable tissue.

It has been observed that in a number of instances naval maxillofacial cases have traveled in a series of laps from the field of action to the hospital responsible for definitive treatment. Several of the cases to be reported were transferred from first aid stations to evacuation ships, to advanced base hospitals, to hospital ships, to base hospitals in the rear, to ships again, thence to a west coast hospital and finally were transported to an east coast hospital. The periods of time elapsing en route between each of the places, as well as the character of the treatment administered, varied considerably. Obviously, the end result attainable for these cases is dependent upon the nature of the treatment administered, the time of such treatment and supervenient infection.

A cardinal requisite for the optimum functional and esthetic end result in maxillofacial surgery is the early replacement of the remaining displaced tissues in as nearly a normal anatomic relationship as possible. This objective may not be attained immediately because of the patient's condition or be-

2. Christopher, Frederick: Textbook of Surgery. Philadelphia: W. B. Saunders Co., 1942, p. 879.

3. Berger, A. R.: Shock; Its Cause and Treatment. D. Outlook 30:101, March 1943.

4. Mahoney, E. B. and Howland, J. W.: Shock, Physiologic and Clinical Aspects. Surgery 13:188, February 1943.

5. National Research Council, Manual of Plastic and Maxillofacial Surgery. Philadelphia: W. B. Saunders Co., 1942, p. 280.

cause of the lack of facilities in forward areas. Nevertheless, at the earliest time possible it is advisable to apply supporting bandages and splints even though the latter are most elementary in type.

Supervening infection may occur with soft tissue slough, osteomyelitis and suppuration. However, if the bony parts are mechanically maintained in a normal position, surgical rest is provided and minimal distortion by scar tissue formation occurs. Furthermore, bony consolidation in malunion is prevented and deep seated infection is less likely to occur. Chemotherapy serves as a valuable aid in the prevention and control of infection. Cultures, indicating the type of predominating infective organisms, should be made to serve as a guide in selecting the most effective chemotherapeutic agent.

There has been an interesting transition in thought in regard to the management of head injury cases exhibiting multiple fractures of the middle third of the face. For many years these patients were placed in a state of complete rest with a "hands off" policy insofar as manipulation and reduction of fractured facial bones were concerned. Current practice based on clinical observations indicates that early treatment may be instituted in the majority of cases. Even though there is fracture of the cribriform plate or other parts of the cranial fossae, it is believed that early reduction, without undue trauma, lessens the risk of an ensuing meningitis owing to the closure of avenues of infection, diminishes the symptoms of shock and places the patient in a more comfortable condition. If protracted treatment for reduction is contraindicated, simple finger or forcep manipulation to accomplish gross reduction has tremendous value.

COMPREHENSIVE DIAGNOSIS

The diagnostic phase of management, although fundamental, is not simple. When the maxillofacial case arrives at a hospital or a maxillofacial center having complete facilities, the opportunity is presented for a thorough examination and diagnosis.

Advantage should be taken of all the hospital laboratory and consultative services for the purpose of formulating a clear mental picture of findings which are essential to rational treatment planning and prognosis. Too much emphasis cannot be placed upon utilizing all available diagnostic procedures. Roentgenographic examination must be of such a nature that displacements of bone, evulsed bony areas and fracture lines are clearly visualized. Roentgenograms of the head should be carefully studied in conjunction with a thorough clinical examination of the patient mainly because of the difficulty in interpretation of roentgenograms of the middle third of the face. Stereoscopic views for skull examination have special value since they provide a third dimension. Questionable areas, not clearly shown in routine roentgenographic examination, should be retaken in a more favorable head position to elicit further information. Complete intra-oral pictures must be

taken to determine the condition of the remaining teeth, their relationship to fracture lines and the existence of pathologic oral conditions. Impressions should be taken of all complicated jaw cases for the preparation of study casts. These casts or duplicates thereof are frequently indispensable for the construction of splints and as diagnostic aids in treatment planning. Photographs, full face and profile, serve not only as valuable records but vividly indicate the cosmetic efficacy of the treatment administered. Laboratory tests, such as urinanalysis, blood chemistry and blood picture, if not within normal limits, may reveal systemic conditions having an important bearing on prognosis and may considerably alter the treatment plan.

TREATMENT PLANNING

Treatment planning is based upon the information gained from a comprehensive diagnosis. The development of a rational plan of treatment represents the integrated thought and cooperative effort of all hospital services sharing the responsibility for the proper care of the patient. Complicated maxillofacial cases frequently require multiple operations so that it is extremely important that such operations be scheduled in a logical, well-planned sequence to the end that the optimum cosmetic and functional result will be obtained. For example, a case may require operations by the neurosurgical service for restoration of a skull defect, by the oral surgical service for multiple fractures of the jaws and by the plastic service for the restoration of tissue losses. Obviously, the best interests of the patient are served by a careful consideration of all elements necessary to the development of a sound plan of treatment. All phases of reconstructive surgery lead to a dual objective: normal function and normal esthetics; and, of these factors, function holds precedence. When some sacrifice must be made, it is good surgical judgment to plan for the optimum functional result at the expense of esthetics. However, a well-considered plan of treatment will usually guarantee a highly desirable end result even for the most difficult maxillofacial cases. The degree of success is often proportionate to the skill and integration of effort of the various hospital services. In complicated jaw cases it is well to remember that restored function is synonymous with restored norm of occlusion. Therefore, the oral surgeon's knowledge of occlusion is invaluable for proper reduction and immobilization. In cases of edentulous and partially edentulous fractured jaws, an effort is made to establish normal alveolar ridge relationships for the optimum accommodation of dentures.

DEFINITIVE TREATMENT

Definitive treatment may be defined as a logical progression in the accomplishment of the various steps outlined in the treatment plan which, in turn, has been predicated upon comprehensive diagnosis. The mechani-

cal contrivances selected to attain traction, reduction and immobilization are multitudinous. These contrivances run the gamut from the "fearful and wonderful" inventions to simple loop wiring. The simplest mechanism which will achieve the desired end result is, as a rule, the most efficacious. The selection of a mechanical device for a specific case is dependent upon the fulfillment of two conditions: (1) traction or pressure to accomplish reduction of the fractured parts and (2) immobilization for a definite period of time.

Various operators achieve equally desirable end results by using different types of appliances. Individual operators are generally better qualified in using those appliances with which they are the most familiar.

Although arch bars and simple wiring may be satisfactorily used for emergency measures, as well as for definitive treatment in selected cases, the early construction of cast splints is indicated for the more severely injured cases which exhibit bony loss and a number of missing teeth. For example, in a case presenting bony loss or comminution of the body of the mandible with a number of missing teeth, an arch bar cannot be relied upon for adequate immobilization. Obviously, for such a case, a sectional cast splint will provide immobilization for the mandible without the necessity of intermaxillary fixation.

The early construction of cast splints for multiple fractures of the jaws has definite advantages:

(a) The segments of fractured jaws may be retained in normal relationship without necessitating constant intermaxillary fixation, thereby materially contributing to the comfort and nutritional welfare of the patient.

(b) A better functional and cosmetic end result is ensured by preventing bony consolidation in malposition and minimizing the formation of scar tissue over collapsed jaws.

(c) Eliminating the necessity for intermaxillary wiring facilitates intratracheal anesthesia, when indicated, by permitting the anesthetist to visualize the larynx for intubation.

(d) When a series of reconstructive operations is necessary, cast splints may be cemented in place for a protracted period of time, thereby ensuring the integrity of the remaining teeth as well as maintaining the displaced parts in normal position.

It is generally believed that fractures of facial bones and comminuted fractures of the malar bones and zygomatic arches are not amenable to satisfactory treatment which has been delayed for a period longer than six or eight weeks. Although early treatment for these cases is highly desirable, considerable improvement has been obtained when treatment has been deferred for six months or longer.

The value of elastic traction in cases of delayed reduction has not been fully appreciated. Elastic traction properly applied between a head cap

attachment and displaced bones will frequently result in what at first appears to be an impossible accomplishment.

Case reports showing imperfect results are frequently as enlightening if not more so than those which show the ultimate in functional and cosmetic end results. Ineffective treatment, when subjected to analytic consideration, is perhaps one of the greatest goads to improvement in treatment procedures. With these thoughts in mind, four diversified cases have been selected from those which have had treatment in the oral surgery service at this hospital.

Fig. 1.—Left: Depressed suppurating wound in the right side of the chin. Right: Oral view showing destruction of the alveolar ridge at the site of injury.

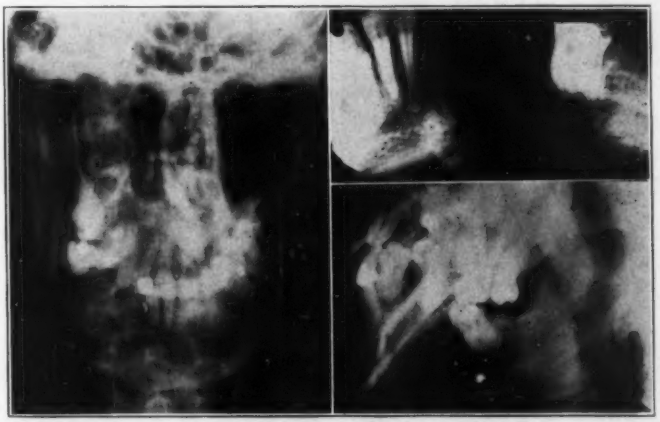

Fig. 2.—Left: Postero-anterior roentgenogram showing bone loss and comminution. Right: Lateral roentgenogram of right body of the mandible. Inset: Roentgenographic view of teeth remaining on both sides of the injured area.

CASE I

SHELL WOUND OF FACE AND MANDIBLE CORRECTED WITH BONE GRAFT AND TANTALUM PLATE IMPLANT

History and Early Treatment.—The patient was a white man, a private of the U. S. Marine Corps Reserve, who was injured on February 22, 1944, when he was struck on the right side of the face by unidentified missiles as a result of a shell explosion on the beach at Guadalcanal. He sustained a severe lacerated wound of the right side of the chin and a fractured mandible. The same day he was taken from the beach by small boat and placed aboard a hospital ship.

Roentgenographic examination at this time showed a comminuted fracture of the right body of the mandible, extending from the symphysis to the right second molar area. Primary closure of the wound was deemed inadvisable. Arch bars were applied to the upper and lower teeth, through-and-through drainage was established and the patient was placed on sulfonamide therapy. He remained aboard the hospital ship until March 3, 1944, during which time the inferior right bicuspids and third molar were removed. He was then transferred to the U. S. Naval Hospital, Aiea Heights, Hawaii, where, despite sulfonamide and penicillin therapy, infection of the right side of the jaw developed. Under general anesthesia, sequestrectomy was performed and several necrotic pieces of bone were removed from the fracture site. On May 1, 1944, he was transferred by transport to the U. S. Naval Hospital, Seattle, Wash., where he was admitted on June 1, 1944, with a suppurating wound of the right side of the jaw. During his one month's stay there he was given supportive treatment and arch bar fixation of the jaws was maintained. He arrived at the U. S. Naval Hospital, St. Albans, N. Y., on August 1, 1944.

Examination.—Clinical examination revealed a retracted, fixed scar, inferior

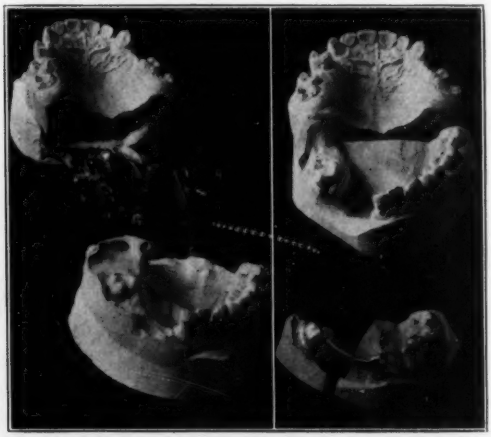

Fig. 3.—Left: Casts mounted on articulator. Right: Duplicate casts.

and lateral to the right labial commissure (Fig. 1, left). The depressed center of the scar exhibited a discharging sinus tract. Cicatricial bands radiating from the center had pulled the lower lip downward rendering it difficult for the patient to control drooling of saliva. There was an obviously ununited fracture of the right body of the mandible with a marked shift of the lower jaw toward the injured side.

Oral examination showed lower teeth to be missing from the right second molar to the left central incisor inclusive, with loss of the alveolar portion of the mandible in this area (Fig. 1, right). Roentgenographic examination (Fig. 2) revealed a loss of about 5 cm. of the right body of the mandible with scattered islands of bone remaining in situ. Although the lower right molar showed considerable alveolar destruction it responded favorably to vitality tests and was quite firm in its attachment. Therefore, it was considered advisable to retain this tooth for control of the posterior fragment. The remaining incisors and cuspid of the anterior fragment were normal.

Treatment.—Impressions were taken, casts were poured and articulated and a cast cap splint was constructed and cemented in place (Figs. 3 and 4).

The sinus tract was explored and several small pieces of necrotic bone were removed. An intensive course of penicillin was instituted to control the infection. By September 1, 1944, drainage had ceased and there was no further evidence of infection. During the interim, August 1944 to December 1945, plastic procedures were instituted. A pedicle tube graft, taken from the right upper chest, was elevated to repair the soft tissue defect of the chin (Fig. 5).

First Operation.—Concurrent with the plastic procedures for repair of the soft tissues, the patient was subjected to two unsuccessful operations. In the first instance, December 21, 1944, the crest of the right ilium was used to bridge

Fig. 4.—Dental splints in place on the teeth.

the gap of missing bone and was wired in place with tantalum wire (Fig. 6, left).

Course.—Infection developed and two submandibular sinuses were established, even though the patient was continuously under penicillin therapy (Fig. 6, right). On April 26, 1945, the wire sutures and several fragments of detached infected bone were removed, along with the infected portion of the bone graft.

Second Operation.—In the second instance, November 27, 1945, the crest of the left ilium was used to supply cancellous bone for bone chips. Operative exposure showed fibrous union between the adjacent bony fragments. Cancellous bone chips were inserted throughout the length of the fibrous tissue attachment with the view of stimulating osteogenesis leading to eventual consolidation (Fig. 7).

Course.—Although no infection ensued, no clinical evidence of consolidation was discernible after a period of three months. A progressive noninfective autolysis of the bone chips occurred.

Third Operation.—In view of the unsuccessful previous operations it was decided to bridge the gap of missing bone by means of a tantalum implant. The laboratory swedged a tantalum trough using a normal mandible as a pattern. Screw holes were drilled through this trough in such a position as to insure the screws engaging solid bone in the adjacent mandibular fragments. On March 3, 1946, operation was performed under intratracheal anesthesia. A submandibular incision 10 cm. long was made to expose the right body of the mandible (Fig. 8, left). Operative findings showed bone chips and fibrous tissue filling in the defect between the bone ends. The tantalum trough was adapted over the mandible and vitallium screws were inserted to maintain it in position (Fig. 8, right). The wound was closed in layers and a pressure dressing was applied.

Course.—Eight weeks after operation, intermaxillary fixation of the jaws was

Fig. 5.—Left: Pedicle graft to right mental area. Right: Plastic procedures after ten months.

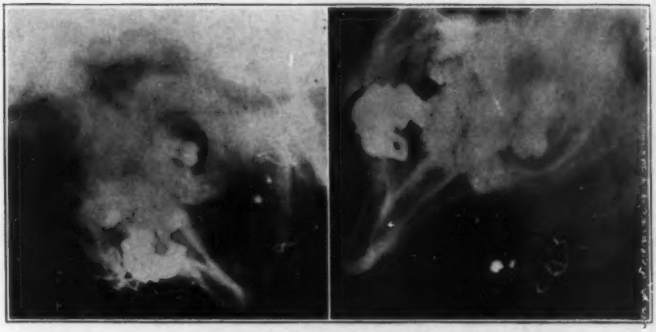

Fig. 6.—Left: Roentgenographic view of first bone graft. Right: Graft absorption four months after operation.

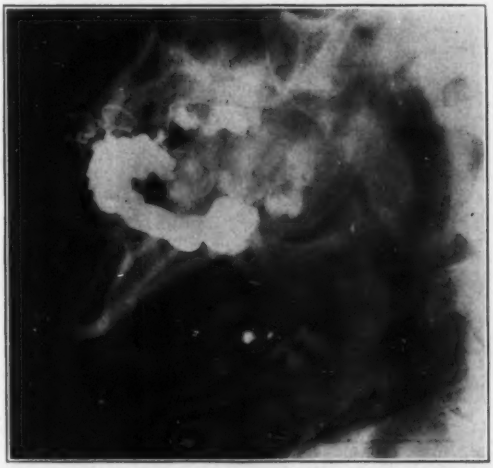

Fig. 7.—Bone chips in place two months after the second operation.

released and the patient was placed on a soft diet. Examination made two months subsequent to the insertion of the tantalum implant demonstrates satisfactory occlusion of the remaining teeth (Fig. 9).

Twelve weeks after operation the mandibular cast sectional splint was removed. Moderate mobility of the right posterior segment was noted, indicating bone absorption around the distal vitallium screws. At no time throughout treatment were the blood, urine, serum calcium, phosphorous and phosphatase tests other than within normal limits. Although the right submandibular tissues, at the site of the several operations, were moderately tense and characteristically cicatricial in nature, there was no evidence of infection. Any further elective

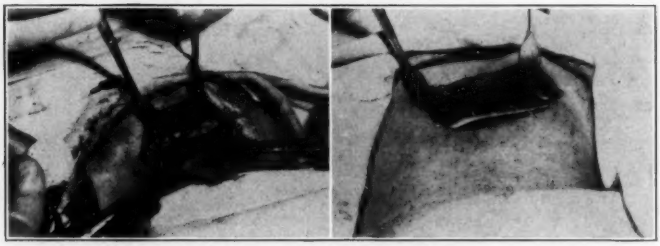

Fig. 8.—Left: Operative exposure for tantalum implant. Right: Tantalum plate insert.

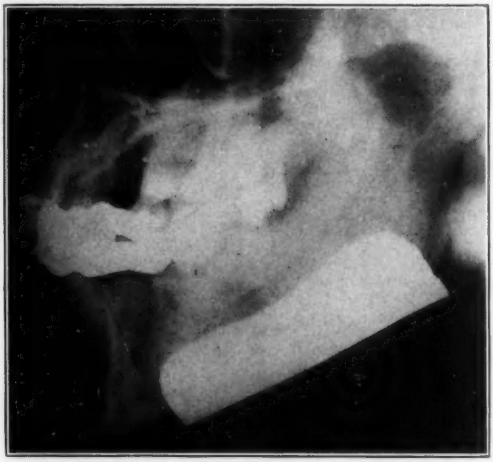

Fig. 9.—Roentgenogram of tantalum implant.

surgical procedure, if indicated, would be inadvisable for approximately twelve months until establishment of requisite collateral circulation. The patient's nutritional intake was adequate, a gain in weight of twelve pounds was manifested over a period of two months, and he had no complaints. The mandibular cast sectional splint was recemented in place and the patient was discharged from the hospital upon being advised to submit himself for observation and possible further treatment at the end of a year.

COMMENT

1. This case brings to light the value of early immobilization of the mandible by means of a cast splint for the lower jaw. Such a splint serves the purpose of adequate fixation to maintain the fractured parts of the mandible in normal position without the necessity of continuous intermaxillary ligation. A cast sectional appliance is considered to be the appliance of choice.

2. Bone chips alone are indicated only in those cases showing a loss of bone not to exceed 3½ cm. However, they do have definite value when used to supplement a fixed graft which bridges the space. They have special value in cases of delayed union where their introduction at the site of the graft serves to promote osteogenetic action. Cancellous bone is quickly revascularized and when properly used, in selected cases, bone chips promote callus formation faster than any other type of transplant.

3. Repeated operations and prolonged infections create scar tissue so that the soft tissue bed for a graft has decreased vascularity. The time interval between operations should be long enough for the establishment of good collateral circulation with increased vascularity which presents more favorable conditions for a successful graft. There should be no evidence of infection for a period of four to six months prior to operation.

4. Chemotherapy is not to be depended upon to abort infections which require incision and drainage. However, it does serve as a valuable adjunct to such surgical procedure.

5. An alternate selection of tantalum wire instead of vitallium screws for fixation of tantalum implants appears to have definite value in those cases showing insufficient bone for the proper insertion and retention of screws.

This patient was last seen on June 13, 1946, at which time he was progressing very satisfactorily. The cast mandibular splint was securely maintained in position, masticatory function was within normal limits, and there was no clinical or roentgenographic evidence of infection.

CASE 2

LOSS AND COLLAPSE OF SYMPHYSIS CORRECTED WITH BONE CHIPS ABOVE TANTALUM PLATE IMPLANT

History and Early Treatment.—On December 24, 1945, the patient suffered two gunshot wounds during a race riot at Samar, Philippine Islands. One bullet entered his left shoulder with exit through the left carotid triangle. The other

Fig. 1.—Right and left profile views of patient upon admittance.

entered the left submental area and passed through the symphysis of the mandible with exit at the chin 3 cm. just to the right of the midline. All wounds healed well except for the fractured mandible.

In January 1946, a splint for immobilization of the mandibular segments was constructed and applied. The splint, which was apparently constructed as an emergency device, firmly secured both segments of the mandible in malposition with resulting nonunion and faulty occlusion.

On March 6, 1946, the patient reported to the Dental Service at the U. S. Naval Hospital, St. Albans, N. Y., for treatment (Fig. 1). A full series of intra-oral and extra-oral roentgenograms was taken and the patient was referred to the Prosthetic Section for preoperative impressions and study models.

Examination.—Clinical examination revealed a loosely-fitting cast metal splint supporting the two mandibular segments. This splint was worn continuously by the patient and could be removed with the slightest tongue pressure. Each mandibular segment to the right and left of the median line was freely movable and a space of approximately 1 cm. existed at the midline. The lower right lateral and central incisors and lower left central incisor were missing. The lower right cuspid was slightly mobile and the lower left lateral incisor was very movable. All remaining teeth responded favorably to vitality tests.

Muscular traction pulled each fractured segment towards the midline, resulting in a collapse at the symphysis and a bilateral malocclusion with the mandibular teeth internal to their normal vertical plane of occlusion (Fig. 6, above).

Roentgenographic examination confirmed the fracture and loss of bone (Fig. 2). Several small comminuted fragments and metallic particles were evidenced in addition to large bilateral fragments on either side of the mentum which appeared to be displaced downward and outward. Both of these large fragments were easily palpable but immovable upon external pressure. A fracture line extended distally from the symphysis along the right body of the mandible to fracture the distal root of the second molar (Fig. 3, left). A lateral view of the left body of the mandible showed an apparently detached bony segment in the

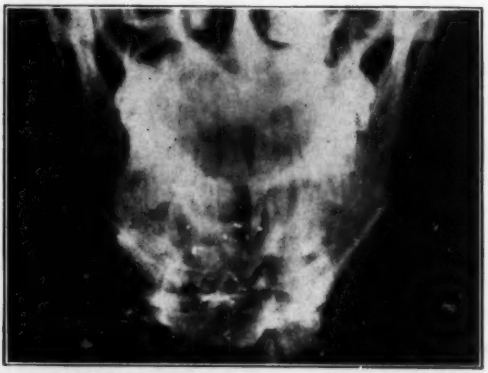

Fig. 2.—Postero-anterior roentgenogram of fractured area.

Fig. 3.—Left: Left lateral roentgenogram demonstrating comminution. Right: Right lateral roentgenogram demonstrating comminution.

Fig. 4.—Splints and casts constructed for separation of collapsed mandibular segments.

mental area (Fig. 3, right). The patient complained of no pain and was managing fairly well from the masticatory standpoint.

Treatment.—On March 13, split arch bars with extensive arms were applied to the mandibular segments for the application of separative elastic traction (Fig. 4). A complete arch bar was applied to the maxillary teeth (Fig. 5, left). Elastic traction was applied and within four days complete reduction was attained (Fig. 5, right). The lateral separation of the segments restored normal occlusion and once this was achieved the elastics were replaced by intermaxillary wires and the extensive arms were clipped off (Fig. 6).

Three days after reduction and fixation, two detached bony spiculae measuring approximately 5 mm. by 2 mm. and 1½ cm. by ¾ cm. were removed from the internal symphysial area. The lower left lateral incisor was extracted and shortly thereafter another bony spicule approximately 1½ cm. by ¾ cm. was removed from the same area.

Operation.—On April 8, 1946, the patient was placed on preoperative medication. On April 9, under 1 per cent procaine hydrochloride infiltration anesthesia and bilateral extra-oral mandibular nerve block, an incision approx-

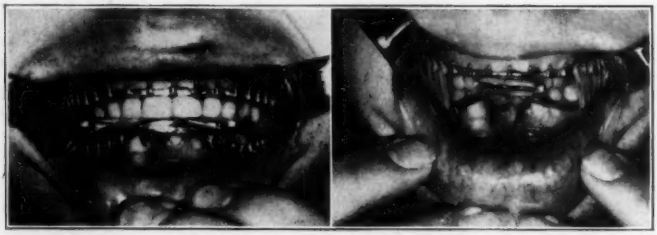

Fig. 5.—Left: Splints on patient and traction applied for one-half hour. Right: Separation of mandibular segments four days after traction, showing desired occlusion.

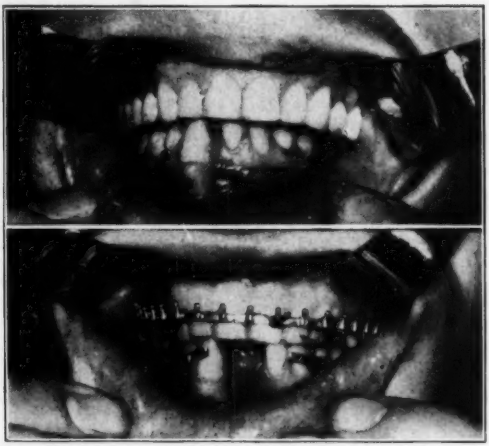

Fig. 6.—Below: Intermaxillary wiring for fixation of desired occlusion. Above: Collapse and malocclusion at time of patient's admittance.

imately 9 cm. long was made submentally to follow the contour of the inferior border of the mandible. The tissue was then dissected in order to expose the anterior mandibular segments. The exposure of the bone was approximately 1½ cm. bilaterally distal to the mental foraminae. During the dissection, in elevating the lingual tissues, a small perforation, 4 mm. in diameter, was made into the oral cavity. A small flap of adjacent fibrous tissue was sutured over the perforation. The dense fibrous tissue formation between the fractured segments was excised and the rough irregular sclerosed bone ends were removed with a rongeur in order to provide blood supply for the graft and to establish symmetry. The bilaterally displaced inferior fragments, shown in the roentgenograms, were found to be well united to the body of the mandible on either side. Although the displacement of both of the fragments was downward and outward, there was no marked deformity (Fig. 7).

Under local anesthesia the crest of the ilium was exposed and cancellous

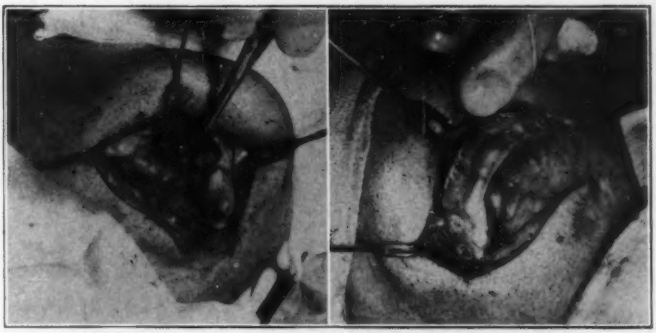

Fig. 7.—Left: Operative view, showing exposed mandibular segments prepared for reception of tantalum implant. Thumb forcep indicates perforation into mouth. Right: Operative view of tantalum splint screwed to place.

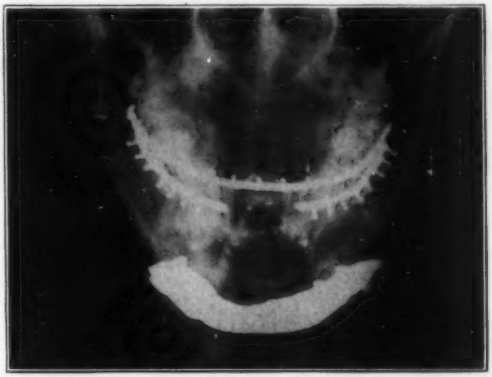

Fig. 8.—Roentgenographic view of tantalum splint in place with bone chips packed into the defect.

bone was removed for the preparation of bone chips. At the same time, a tantalum plate, .015-inch thick, which had previously been swedged to proper contour, was fitted over the gap and screwed into place with vitallium ⅜-inch screws on either side (Fig. 7, right). The insertion of the screws provided good stability to the fragments so that they were immovable even under considerable stress. The cancellous bone, which was removed from the crest of the ilium, was cut into small chips ranging from the approximate size of a pea to about 1 cm. square. These chips were packed into the bony defect and contoured by manipulation to the shape of the trough produced by the tantalum splint. The chips completely filled the space formed by the previous loss of bone (Fig. 8). A microcrystalline sulfonamide emulsion was injected into the wound to control infection, since a communication with the oral cavity had been established.

Fig. 9.—Profile of patient before and after operation.

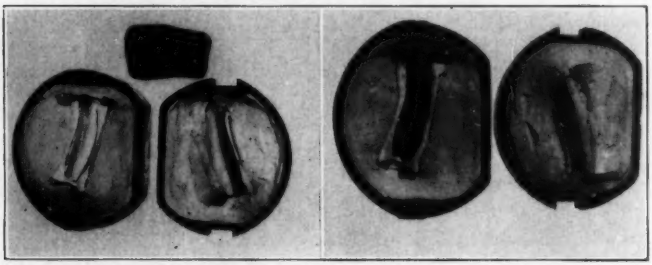

Fig. 10.—Left: Flasked die and counterdie of artificial stone. Right: Swedged tantalum plate embedded in artificial stone.

Both wounds, submandibular and iliac, were closed by suture. A drain was inserted into the surgical wound of the left hip.

Course.—The patient's preoperative dosage of penicillin was 20,000 units every three hours. Postoperative dosage was changed to 50,000 units every three hours. During the week following the operation a total of 2,800,000 units of penicillin was administered parenterally. The postoperative course was uneventful except for a slight chest cold which developed a few days after the operation. A spiked temperature ranged from 102.2 degrees to normal through the sixth postoperative day and from that time on it was within normal limits. The sutures were removed ten days after the operation. Throughout the entire treatment period, good oral hygiene was stressed and practiced by frequent sprays and rinses. An adequate nutritional intake resulted in a gain of five pounds in weight three weeks after operation (Fig. 9).

COMMENT

1. A tantalum implant was indicated for this case because extensive destruction of the alveolar portion of the mandible precluded the use of a graft of sufficient bulk to provide requisite strength. Healing had resulted in tissue at-

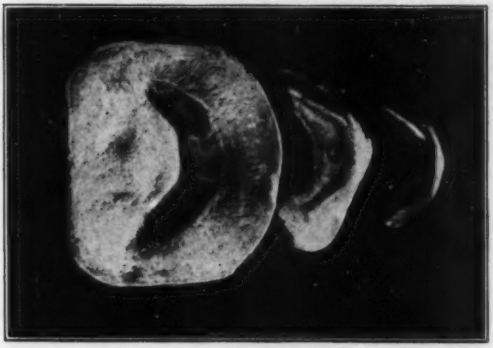

Fig. 11.—Metal die, counterdie and swedged tantalum plate.

Fig. 12.—Swedged tantalum plate and special screwdriver for handling bone screws.

tachment of the floor of the mouth quite close to the inferior border of the mandible. It is believed that this case is unique in that a combination of a tantalum plate implant supplemented by bone chips has been employed to bridge the area of evulsed bone. The metallic implant and intermaxillary wiring afford the rigid immobilization of the mandible necessary for osteogenesis. If only bone chips or a small bone graft had been employed, sufficient strength would not have been provided even though union had occurred. The bone chips served as building stones for tremendous osteogenetic activity; marked callus formation was palpable four weeks after operation.

2. Another interesting feature of this case is the freedom from postoperative infectious sequelae despite the unfortunate perforation of the floor of the mouth during operation. It is believed that the administration of penicillin, as well as the local use of microcrystalline sulfonamide emulsion, were the factors responsible for controlling infection.

3. Tantalum as a metallic implant for bony loss in the mandible appears to have great value when a strut is required to restore function and anatomic form. Although this metallic element cannot be cast, it is readily swedged in the dental laboratory to any desired form. It is well tolerated by the tissues, easy to manipulate and of sufficient strength to meet functional requirements.

Construction of a tantalum plate for loss of mandibular bone involves the following procedure:

(a) A mandible, approximately the same size as the patient's, is selected as a

model. An impression is taken of that part of the model which corresponds to the patient's loss of bone.

(b) The impression is poured in artificial stone or low-fusing metal to form a die (Fig. 10).

(c) The desired outline of the tantalum plate is grooved on the metal or plaster die with a round bur. The outline should be 3 to 4 cm. larger in overall length than the actual length of the bone loss. This additional length will compensate for the removal of the sclerosed bone ends and at the same time provide an overlap of metal to accommodate the bone screws.

(d) A counterdie, of the same material as the die, is constructed.

(e) The oversized tantalum plate is then swedged between the die and the counterdie (Fig. 11). A flask press may be used to provide gradually increasing pressure when the plate is swedged between stone models.

(f) The tantalum plate is trimmed to proper size, the edges are smoothed with stones and holes are drilled in either end for the reception of bone screws. Two screws on either end of the tantalum plate will usually serve to fix the mandibular segments firmly. As a time-saving feature, it is well to have as many as four holes drilled on each side of the plate to permit a selection of the most desirable holes for adequate fixation (Fig. 12).

On July 5, 1946, an inflamed area about the size of a dime appeared beneath the point of the chin. Two days later the tissue perforated, a sinus was established and slight drainage, apparently seropurulent in nature, occurred. Laboratory examination of the exudate was reported negative. Exploration of the sinus and roentgenographic study showed no evidence of bony pathology. Two penicillin-sulfanilamide cones, 5,000 units: 1 grain, were introduced into the sinus and 50,000 units of penicillin was administered parenterally every three hours for seven days. By July 25, 1946, the sinus had closed and there was no clinical or roentgenographic evidence of infection. The patient was separated from the Naval Service on August 10, 1946.

CASE 3

NONUNION OF FRACTURED MANDIBLE CORRECTED WITH BONE GRAFT

History and Early Treatment.—The patient gave a history of being struck by fragments of a rocket shell which exploded near him during battle, March 10, 1945, on the island of Iwo Jima. Although the history states that "fragments from rocket shell struck right side of jaw with resulting fracture of mandible," a clinical study of the case leads to the more logical assumption that the patient was struck by some unidentified nonperforating object as the result of the explosion. This assumption is made in view of the fact that, in bomb fragmentation cases, metallic parts in the soft tissues are usually demonstrated by roentgenographic examination. The rocket shell exploded about thirty yards from where the man was located.

A general physical examination demonstrated nothing of consequence. Maxillofacial examination revealed a lacerated wound of the right mental area with a compound comminuted fracture of the right body of the mandible and a

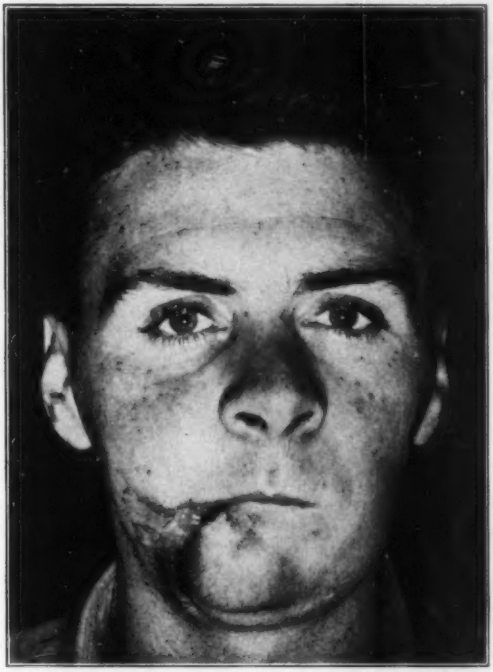

Fig. 1.—Full face view of patient.

compound fracture through the first molar area of the left body of the mandible (Figs. 1 and 2). Muscular traction had caused a collapse of the lower jaw, creating the typical triangular, lingually displaced mandible with loss of normal chin prominence.

An emergency operation was performed for débridement of the wound on the night of March 10, 1945. The patient was removed to a hospital ship on March 12, at which time a head cap was placed in position for outward traction of the displaced anterior part of the mandible and intermaxillary wiring was employed for control of the posterior mandibular fragments. The patient was then transferred to Guam, M. I. There is no record of any further treatment until the patient was admitted to the U. S. Naval Hospital, Oakland, Calif., where the head cap and all appliances were removed.

Examination.—On May 2, 1945, this man arrived at the U. S. Naval Hospital, St. Albans, N. Y. The wound of the right jaw was partially healed and slight drainage of a purulent nature was present. Roentgenographic examination confirmed the clinical findings and demonstrated a fracture of the left body of the mandible in the first molar area and comminuted fracture with loss of bony

Fig. 2.—Right and left profile views of patient.

Fig. 3.—Postero-anterior roentgenogram of mandibular fractures.

substance in the right mental area (Figs. 3 and 4). The anterior segment of the mandible was rotated toward the more severely injured right side.

Treatment.—By May 14, drainage had ceased and the Plastic Service instituted operative procedures to release the tension of the scar tissue around the mouth in order to afford greater mobility to the lower lip and thus minimize drooling of saliva. The scar at the right corner of the mouth was opened, allowing the lower lip and soft tissues of the chin to assume a better relationship. About one-half of the lower lip was missing. No attempt was made to close the incision. A small sequestrum was removed from the mental area. It was observed

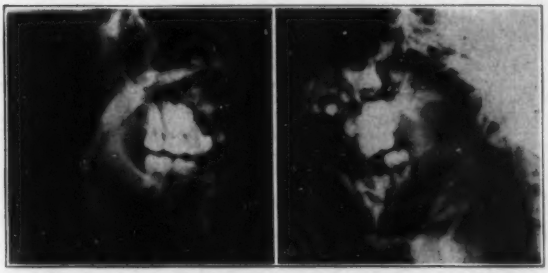

Fig. 4.—Left: Fracture of left body of the mandible. Right: Comminuted fracture, right mental area.

that there was a loss of bony substance extending from the right molar area to the symphysis.

On June 7, the superior right cuspid and first molar were extracted for reasons which have not been recorded.

First Operation.—On June 19, a plastic operation was performed, consisting of raising a skin flap from the right side of the neck with the base in the region of the mastoid and tipped just above the clavicle. The tip of the flap was not cut across. The flap was sutured back in its original bed and pressure dressings were applied.

Course.—On July 16, the patient developed slight swelling of the left side of the face with a draining intra-oral sinus. Free drainage was established. An osteomyelitis of the mandible was suspected but was not confirmed by roentgenographic findings.

By July 30, all the sutures had been removed from the site of the cervical flap. This wound was still open and required daily dressings. The pedicle flap was in good condition. The swelling at the left angle of the jaw was still apparent with drainage in the left inferior molar area.

On August 27, incision was made at the left angle of the jaw and a drain was inserted. Routine postoperative treatment, daily changing of dressings and intra-oral irrigations were employed. Since June 6, the patient had been on chemotherapy, consisting of sulfadiazine and penicillin. During the period from March 18 to June 6, 2,970,000 units of penicillin was used in conjunction with sulfadiazine therapy.

By September, drainage from the left angle of the mandible had ceased and there was no roentgenographic evidence of sequestration.

Second Operation.—On September 11, the cervical flap was raised and found to be in good condition. The scar in the right corner of the mouth was excised, permitting tissues to assume normal position. The tip of the flap was folded in itself to form lining and covering for the missing part of the lip. It was sutured in place (Fig. 5). On October 2, the pedicle was cut. Plastic repairs for the time being were terminated on October 8.

Orthodontic Treatment.—On January 9, impressions of the upper and lower arches were taken. A cast appliance was made for the remaining inferior teeth

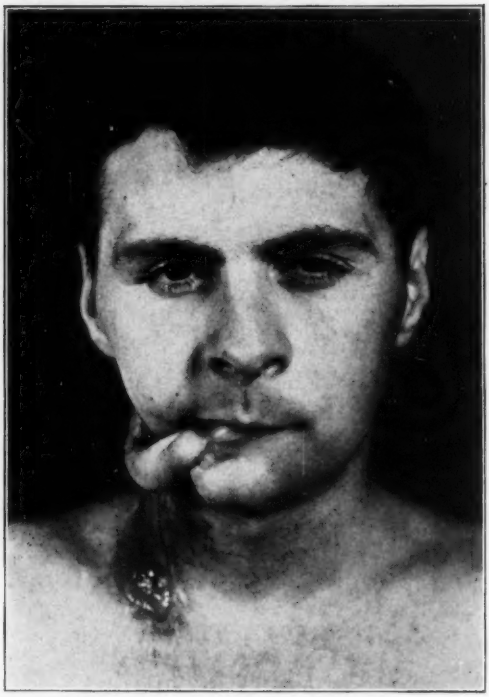

Fig. 5.—Pedicle tube graft in place.

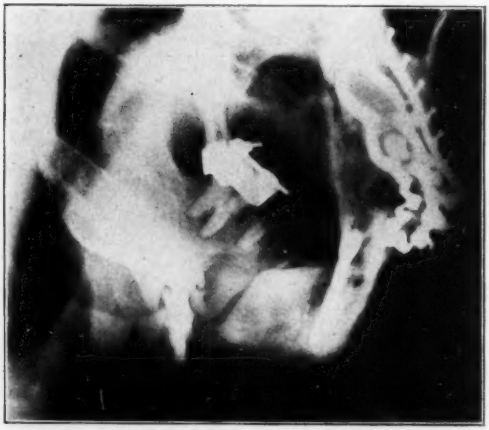

Fig. 6.—Superior and inferior right molars with molar sheath bands in place.

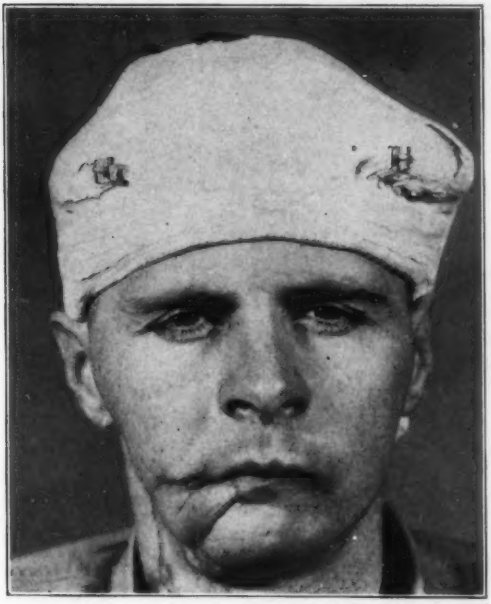

Fig. 7.—Head cap applied for traction. Primary restoration of lip by pedicle tube graft.

and an arch bar segment was applied to the remaining teeth in the superior left arch. On the right side, the superior and inferior second molars were all that remained. These were banded with orthodontic molar sheath bands (Fig. 6). Intra-oral roentgenograms showed a transverse fracture of the crown of the inferior right second molar. It was deemed advisable to retain this tooth for control of the posterior fragment.

On January 19, a plaster head cap was applied to carry necessary appliances for traction and immobilization of the mandibular segments preparatory to a bone grafting operation (Fig. 7). The left mandibular segment was displaced 2 cm. to the right of the midline by muscular traction with its upper border rotated lingually (Fig. 8). Elastic traction was employed to accomplish reduction of the displaced parts. Traction wires were applied to each mandibular segment for the application of elastic traction between the dental splints and the headcap appliance. The objective was to obtain optimum alveolar ridge relationship on the right side and satisfactory occlusion of the remaining teeth on the left side (Fig. 9).

Course.—The resulting forces were sufficient to break down the fibrous union between the two segments of the mandible, thus providing more desirable conformation of the lower jaw (Fig. 10).

On January 22, the mandibular segments were found to be in a desirable

Fig. 8.—Dental splints in place.

relationship as determined by previous study casts. Intermaxillary fixation was accomplished at this time by wiring the segments securely in their reduced positions. The patient was then ready for the bone grafting operation.

Third Operation.—On March 5, anesthesia was induced with intravenous injection of pentothal sodium and endotracheal administration of ether. The right body of the mandible was exposed and both ends of the exposed bone fragments were chipped and beveled for reception of the bone graft. A portion of the crest of the left iliac bone, measuring approximately 5 cm. by 2.5 cm., was removed. This bone was shaped to the proper size so that it could be wedged in between the segments of the mandible and still overlap approximately 1.5 cm. on either side. Two holes were drilled in both overlapped ends of the graft in proper relationship to the underlying mandibular segments. A .014-inch stainless steel wire was used to ligate each end of the graft to the mandible. The space between the segments of the mandible at rest was approximately 2.5 cm., while the small length of the wedge portion of the graft was 3.0 cm. This difference in length provided good approximation of segments and graft (Fig. 11).

To provide additional fixation of the right ramus, and thus ensure the integrity of the bone graft, a puncture wound was made superficially over the right angle of the mandible and a hole was drilled through the angle. An 18 gage stainless steel wire was inserted through this hole and left protruding from the wound. The free end of the Darcissac wire, when secured to the head

Fig. 9.—Application of elastic traction.

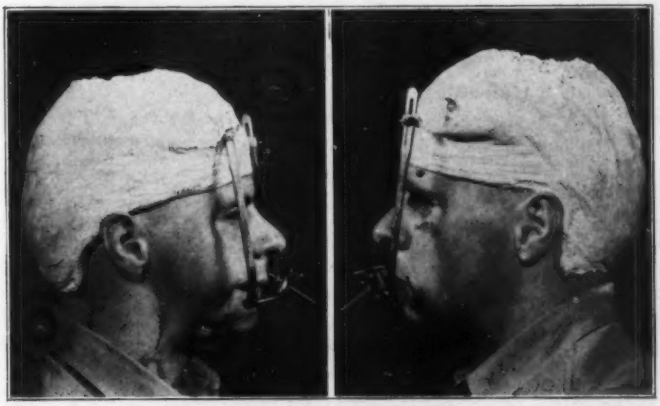

Fig. 10.—Restoration of chin contour. Lateral views of appliances.

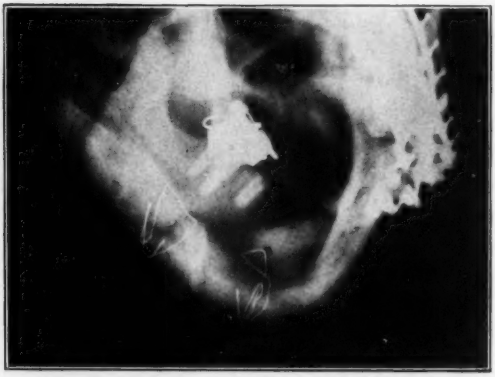

Fig. 11.—Roentgenogram of bone graft in place.

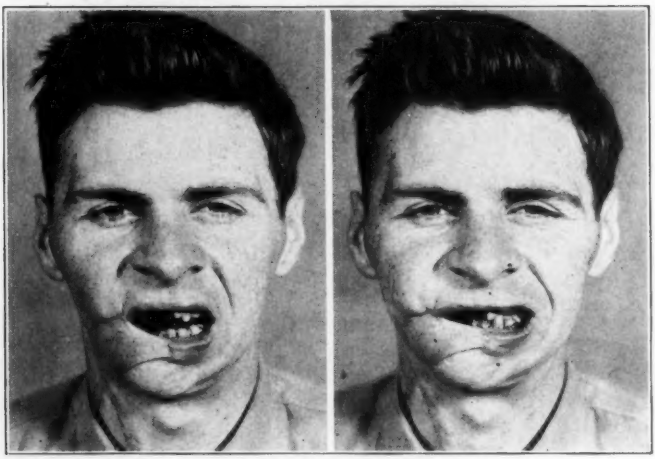

Fig. 12.—Occlusal relationships after bone grafting.

cap, afforded greater stability to the fractured mandibular segment. The wound was closed in layers and a pressure dressing was applied.

Course.—The patient was given routine postoperative antibiotic therapy consisting of 50,000 units of penicillin every three hours. Supportive treatment, forced fluids and adequate nutritional intake were maintained. By March 12, postoperative edema had markedly decreased.

On April 23, seven weeks after operation, intermaxillary fixation of the jaws was released. Examination at this time demonstrated excellent union of the graft with the mandibular segments and good relationship of the dental ridges

(Fig. 12). The patient was placed on a soft diet and referred to the Plastic Service for further treatment of the soft tissue defects.

At such time as consolidation has progressed sufficiently for performance of necessary extractions, prosthetic replacements will be constructed to re-establish complete masticatory function.

COMMENT

This case brings to light several important points:

1. Early fixation of displaced bony parts by means of adequate dental splints is mandatory if the best cosmetic and functional end result is to be accomplished.

2. Although it is highly desirable to extract a questionable tooth which may become infected and jeopardize the integrity of a bone graft, it is sometimes advisable to retain such a tooth when its retention is essential for the control of a jaw segment.

3. Control of infection is better served by rational rather than empirical practice. Infective organisms should be identified by laboratory methods so that an effective chemotherapeutic or antibiotic agent may be selected.

4. As a part of the original examination, complete intra-oral roentgenograms should be taken of dentulous and edentulous areas. To minimize supervenient infection, good judgment as a rule indicates the early removal of retained roots. In the event that roots and questionable teeth are left in position, it is imperative that dental splints be of such a nature as to permit extraction at the first sign of an infectious flare-up.

On July 8, 1945, there was no essential change in the patient's maxillofacial condition. The inferior and superior right second molars were extracted and alveolectomy was performed in preparation for the construction of unilateral partial dentures. On August 1, 1946, dental impressions were taken and partial dentures were being constructed for restoration of masticatory function. The patient has satisfactory occlusion of the remaining teeth on the right side and good alveolar relationship on the left side. The Plastic Service has the patient scheduled for further correction of the facial soft tissue defects subsequent to the insertion of dentures.

CASE 4

DEPRESSED FRACTURE OF THE FRONTAL BONE AND MALAR ZYGOMATIC COMPOUND, COMPLICATED BY MENINGITIS; TANTALUM FOIL CRANIAL IMPLANT AND SUCCESSFUL LATE REDUCTION OF THE MALAR FRACTURE

History and Early Treatment.—The patient was a white man, aged 18, who, on the night of December 30, 1945, while disembarking from a train in a railway station, slipped on the ice and fell upon the side of his head (Fig. 1). He vaguely remembers getting up and falling again. The patient recalls being taken by the police to the Rahway Memorial Hospital where he underwent operation. About two days later, the patient stated, he regained a clear mem-

Fig. 1.—Full face view of patient 1½ years before injury.

Fig. 2.—Full face and profile views showing injury.

ory. He remained in the Rahway hospital until January 16, during which time postoperative dressings were changed and his left eye was treated.

The family history was irrelevant.

Examination.—Physical examination upon admission to the U. S. Naval Hospital, Brooklyn, N. Y., revealed a well-developed, well-nourished man, alert

Fig. 3.—Roentgenogram showing multiple fractures of the orbital bones.

but apprehensive and slightly belligerent. Temperature, pulse and respiration were normal; blood pressure was 130/160. There was an oval, linear vertical depression in the left frontal region, 7 cm. long and 8 cm. wide, with a scar in the left frontal area (Fig. 2). A protuberance of the left zygomatic arch and a depression of the left malar bone were noted. There was a depression of the left supra-orbital and infra-orbital ridges and a palpable irregularity of the left body of the mandible. The patient could not open his mouth completely. Occlusion was normal and the pupils were equal and regular. There was a depression of the left ocular globe.

Roentgenographic examination of the head, on January 16, 1946, revealed an irregular defect of the left frontal bone, 4½ cm. wide and 7 cm. in length. One fracture line ran laterally from the midpoint of this defect and swung around to involve the wing of the sphenoid bone. There was apparent communication with the left frontal sinus and the left supra-orbital ridge was depressed. The left body of the mandible was fractured anterior to the lower left first molar. There was a 2 cm. segment of the left infra-orbital ridge depressed into the left maxillary sinus and a 1 cm. portion of the superior orbital plate, posterior to the supra-orbital ridge, apparently had been displaced into the left orbital cavity. There was comminuted fracture of the anterior wall of the left maxillary sinus and lateral displacement of the left zygomatic arch (Fig. 3).

On January 25, 1946, this patient was admitted to the U.S. Naval Hospital, St. Albans, N. Y. Findings by physical examination were essentially the same as those found at the Brooklyn Naval Hospital. The patient's complaints at

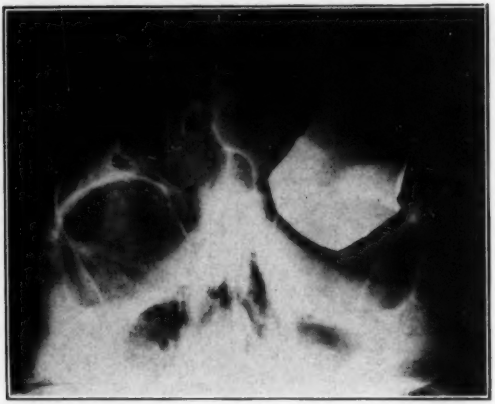

Fig. 4.—Tantalum foil implant.

this time were a slight soreness of the jaw (owing to mandibular fracture), blurring vision of the left eye and diplopia. There was pronounced deformity of the left orbital area of the face. The patient evidenced no headaches or dizzy spells. All laboratory examinations were essentially negative. There was no cerebrospinal rhinorrhea.

Treatment.—On February 11, the patient was transferred to the Dental Service for reduction and correction of maxillofacial injuries. Five hours after admission to the dental ward, the patient exhibited convulsions and was returned to the Neurosurgical Service with a diagnosis of pneumococcal meningitis. Over a period of two days he was given a total of 820,000 units of penicillin. On February 14, a tantalum foil implant was placed between the dura and the fractured frontal sinus in an attempt to wall off any avenue of infection to the dura and meninges (Fig. 4).

Course.—Consultation with the Neurosurgical Service had resulted in a decision to defer all operative procedures until such time as the patient's condition showed him to be a good operative risk. A convalescent period of six weeks was required for favorable recovery from the attack of pneumococcal meningitis. Nose and throat cultures were still positive for pneumococci, although growth was slight.

Examination.—On March 3, the patient was readmitted to the Dental Service for treatment. Maxillofacial examination revealed a marked downward and inward displacement of the left malar bone with a lateral bulge of the zygomatic arch. Partial consolidation of the fracture of the left body of the mandible had occurred and the occlusion of the teeth was satisfactory.

Findings in ophthalmologic examination follow: "The left eye had dropped and receded in the orbit as the result of the displacement and comminution of the orbital bones. There was a lagging of the left eye in the field of action of the left superior rectus, left inferior rectus and left superior oblique muscles. The above findings may be explained on the basis of a derangement of the

Fig. 5.—Full face and profile views one week after operation.

Fig. 6.—Postero-anterior roentgenograms taken preoperatively and postoperatively.

angles of action of the muscles by displacement of the left globe down and backward. Considerable improvement may be anticipated following reduction of the displaced bones."

Operation.—On March 21, eighty-one days after injury, under pentothal sodium induction and ether anesthesia, an intra-oral horizontal incision, approxi-

Fig. 7.—Postoperative full face view and same view one month after operation.

mately 3 cm. long, was made in the mucobuccal fold simulating a Caldwell-Luc approach to the left maxillary sinus. Elevation of the mucoperiosteal flap revealed a severely comminuted anterior wall of the left maxillary sinus and infra-orbital ridge, although the lining membrane of the sinus was normal in appearance. Reduction of the fractures was accomplished by using a large, curved hemostat, the beaks of which were covered with gauze. Through an opening in the anterior wall of the sinus, the displaced fragments were molded into position and the floor of the orbit was elevated to raise the pupillary level of the eye. The fibrous attachments of the malar bone and zygomatic arch were disrupted, the malar bone was elevated upward and outward, and at the same time medial compression was applied to the distended zygomatic arch. The sinus was firmly packed with vaseline gauze to maintain the reduced bones in position and a fenestrated rubber tube was inserted to permit instillations of penicillin solution. Figure 5 shows the patient's appearance one week after the operation.

Course.—The patient was placed on chemotherapy, consisting of 60,000 units of penicillin every three hours throughout the day, supplemented by irrigations of the sinus with penicillin solution through the rubber tube four times daily. From April 4 to April 17, the gauze packing was removed a third at a time on three successive days. The opening in the mucobuccal fold was closed by suture.

Examination.—On April 23, thirty-two days after operation, the patient was referred to the Eye Clinic for ophthalmologic examination. The following report was submitted: "In summary, his case originally showed considerable orbital deformity with left eye displaced downward with resultant diplopia in all fields below the horizontal position. Now, after correction, there is no

muscular imbalance, binocular vision is normal and the cosmetic results are excellent."

Final roentgenograms taken seven weeks after reduction of the fractures show reduced lateral dimension of the orbit. The infra-orbital ridge and floor of the orbit have been satisfactorily elevated in position with improved continuity of the infra-orbital ridge (Fig. 6, lower).

The loss of bone in the left frontal region and the soft tissue defect are scheduled to be treated after satisfactory convalescence. The Neurosurgical Service plans to restore the defect in the left frontal area by means of a tantalum implant.

COMMENT

1. The severe nature of this patient's injuries precluded operation for reduction of his facial bones until eleven weeks after his accident. Although operation is advisable at an early date, delayed operative procedures frequently produce a highly desirable result. The longer the time elapsing after the injury, the greater the disruptive force that will be required for reduction to re-establish normal bony conformation.

2. Reduced fractures of the zygomatic arch frequently require intermaxillary immobilization or external fixation if ensuing displacement of the fragmented bones is to be avoided. The zygomatic arch attachments of the quadratus labii superioris, zygomaticus and especially the masseter muscles must be remembered. These muscles should be placed in a state of rest or their muscular pull should be counteracted if reduction is to be maintained for the more severely injured cases. Even though complete reduction of the zygomatic arch was accomplished for this case at operation, close observation of Figure 7 demonstrates some subsequent displacement as the result of muscular activity.

The patient's maxillofacial condition is the same as previously reported. The Neurosurgical Service inserted an inlay type of tantalum implant in the left frontal region for restoration of the skull defect on May 22, 1946. There has been a gain of weight of fifteen pounds and the patient is in a good physical and mental condition. He is to be discharged from the hospital August 16, 1946.—*U. S. Naval Hospital.*

USE OF PENICILLIN IN THE TREATMENT OF VINCENT'S INFECTION AND ITS SUBSEQUENT ORAL DISTURBANCES

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GEORGE EDWARD MEYER,† D.D.S., Chicago

The chemotherapeutic effects of penicillin in certain spirochetal infections have been successfully demonstrated. Mahoney[1] was able to show the therapeutic effects of penicillin on the spirochete of syphilis by the intramuscular administration of the drug. Careful studies demonstrated a negative darkfield illumination within a few hours after the administration of the drug. This work was later confirmed by Pyle,[2] when 25,000 units of penicillin was administered every three hours intramuscularly to patients suffering with primary chancre. His darkfield examinations were positive through the eighth hour following institution of treatment but specimens obtained at twelve hours did not contain the Treponema pallidum.

With some knowledge of the spirocheticidal potentiality of penicillin in the treatment of the patients in this hospital for acute infections such as osteomyelitis of the mandible, acute cellulitis and deep neck infections, we observed a complete absence of inflammation of the mucous membranes of the mouth and an unusual tissue tone, in that it was free of the usual sluggishness which so often accompanies illness. Four of the patients under treatment gave histories of once having had Vincent's infection. They felt that they had never completely recovered, for they were disturbed by spontaneous bleeding from the gums and acutely sore mouths. After the administration of penicillin there was no apparent clinical evidence that would substantiate their past histories. These observations were later confirmed by Strock,[3] who states that there is an apparent relationship between the condition of the gingivae and the administration of penicillin. He also noted a remarkable improvement in the gingivae and general tone of the mouth tissue. In treating Vincent's infection with penicillin he observed a prompt improvement and the relief of all subjective symptoms within the first twenty-four hours.

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1. Mahoney, J. F., Arnold, R. C. and Harris, A.D.: Penicillin Treatment of Early Syphilis; Preliminary Report. Ven. Dis. Inform. 24: 355, December 1943.

2. Pyle, H. D.: The Use of Penicillin in Vincent's Angina. J.A.M.A. 128:706, July 7, 1943.

3. Strock, A. E.: Relationship Between Gingivitis and Penicillin Administration. J.A.D.A. 31:1235, September 1, 1944.

This disease appeared in endemic proportions during World War II and the attention of dentists and physicians was again focused on this pathologic entity. Many treatments and cures were established and there seemed to exist a therapeutic chaos regarding this problem disease. Penicillin, a new drug being used experimentally for the first time in the treatment of Vincent's infection, did not help to clarify the situation. With this knowledge and from our observations we have made some attempt to approach a rationalized treatment.

TYPES OF CASES TREATED

The patients treated were men and women of the armed forces, aged 19 to 38. About 90 per cent of the total number of cases treated were of an acute nature. The diagnosis of Vincent's infection was established for each patient by clinical symptoms which were confirmed by a microscopic examination of a fresh smear taken directly from an ulcer or a periodontal pocket. Cultures were taken from each patient to rule out any other pathogen. Approximately 18 per cent of the total number of cases treated showed definite subjective and objective clinical evidence of Vincent's angina in conjunction with Vincent's infection.

Vincent's infection may occur in two quite dissimilar forms which are best described as acute and subacute. Some other observers tend to disagree with this classification. Nevertheless, there is a type of Vincent's infection in which many of the characteristic symptoms of the acute form are absent. While having the same appearance of chronic gingivitis, these cases are quite different in their symptomatology. The acute infection follows a definite type and pattern and is easily recognized. It is usually accompanied by chills and fever and the breath has an extremely offensive odor. The involved gingivae are characterized by a marked inflammation, swelling and the formation of a patch or patches of pseudomembrane separated from one another by normal healthy tissue. When the pseudomembrane is removed a raw, bleeding surface is left. The re-formation of this membrane takes place quite readily. In the subacute form, all the symptoms are definitely less marked. There is no slough. The patient is usually afebrile although I have seen a few cases where there was a rise in temperature towards the end of the day. There is less inflammation to the gingivae and mucous membranes of the mouth. The tonsils are never involved and there is no debility.

METHOD USED IN ESTABLISHMENT OF DOSAGE

Owing to the apparent lack of knowledge of a standard or an effective minimum dose in the treatment of this disease, we selected sixteen patients who were all admitted to the hospital. Penicillin was administered intramuscularly every three hours, twenty-four hours a day, in doses varying from

20,000 units in Group 1 to 40,000 units in Group 4. In order to determine the clinical and bacteriologic effectiveness of the different-sized doses, each group was subjected to a detailed daily microscopic study and all clinical findings were recorded.

Group 1.—A dose of 20,000 units of penicillin in sterile distilled water (10,000 units per cubic centimeter) was administered intramuscularly every three hours, continuously. No supportive treatment was given to this group except acetylsalicylic acid 5 grains, when necessary for the relief of pain. When necessary, this supportive treatment was also carried out in Groups 2, 3 and 4. Smears were taken every twenty-four hours until a negative finding for Vincent's organisms was reported. To further confirm negative findings, another smear was taken at this time. This method of confirmation was carried out in groups 2, 3 and 4. During the time penicillin was being administered, the patient was observed daily for any clinical evidence of improvement. In this group the average total dose administered to produce negative microscopic findings for Vincent's organisms was 500,000 units. The average number of days penicillin was administered was three and one-eighth. There was practically no change in the clinical picture before the beginning of the third day. When questioned concerning pain and the usual discomfort associated with this infection, patients stated that they noticed very little if any change in their subjective symptoms until the third day.

Group 2.—A dose of 25,000 units of penicillin in sterile distilled water (10,000 units per cubic centimeter) was administered intramuscularly every three hours, continuously. This group, as in group 1, was observed daily for clinical evidence of improvement. Smears were taken daily until a negative smear for Vincent's organisms was obtained. The average total dose administered to produce negative microscopic findings for Vincent's organisms was 390,000 units. The average number of days penicillin was administered was two and three-quarters. The clinical picture observed in this group was a little more striking, in that there was a decrease in inflammation and odor and a definite relief from pain at the end of the second day. There was no improvement in the appearance of the ulcers in this group and no noticeable change in the amount of hemorrhage from the gingivae until after penicillin had been discontinued.

Group 3.—A dose of 30,000 units of penicillin in sterile distilled water (20,000 units per cubic centimeter) was administered intramuscularly every three hours, continously. Smears were taken every twenty-four hours until a negative finding for Vincent's organisms was reported. Patients were observed daily during the administration of the drug for clinical evidence of any improvement of the disease. The average total dose administered to produce negative microscopic findings for Vincent's organisms was 360,000 units. The average number of days penicillin was administered was one and one-half. This group attracted immediate attention as there was a definite clinical im-

provement existing the second day after the administration of penicillin. After twenty-four hours of treatment the subjective symptoms became progressively better hourly, and the patients noticed a distinct subsiding of pain. Objectively, there was a marked decrease in odor and hemorrhage. There were no new ulcers, less inflammation and the general tissue tone of the mouth seemed much improved. There was a marked improvement in the primary irritation and the contents of the débris-filled septic pockets showed a definite reduction.

Group 4.—A dose of 40,000 units of penicillin in sterile distilled water (20,000 units per cubic centimeter) was administered intramuscularly every three hours, continuously. The average total dose administered to produce negative microscopic findings for Vincent's organisms was 365,000 units. The average number of days penicillin was administered was one and one-third. There was no clinical evidence of improvement in this group that was not observed in group 3 over the same length of time. The increase in the number of units of penicillin administered did not achieve the additional beneficial results that had been obtained in group 2 over group 1, and in group 3 over group 2. The number of days required to produce a negative smear remained approximately the same as in group 3.

COMPARATIVE THERAPEUTIC RESULTS: GROUPS 1, 2, 3 AND 4

In estimating the rapidity with which the Vincent's organisms disappeared after administration of the drug, the smear taken prior to the administration is presumed to represent 100 per cent. In Group 1 there was a reduction of approximately 50 per cent of the organisms after twenty-four hours. The Vincent's organisms were progressively reduced by the continuous administration of the drug until smears were reported negative.

In Group 2 the reduction of the number of Vincent's organisms after twenty-four hours was approximately 65 per cent. Smears showed a progressive numerical lessening of organisms by the continued use of the drug until negative smears were obtained. In Groups 3 and 4, after penicillin had been administered for twenty-four hours, there was a reduction in the microscopic findings of the Vincent's organisms estimated at about 91 per cent.

After careful study of subjective and objective clinical findings in these four groups it was demonstrated that penicillin is a remarkably effective therapeutic agent in the treatment of Vincent's infection and that the spirilla and fusiform bacilli are extremely sensitive to this drug. There appears to be some limit to the systemic absorption of the drug and to its relationship or its efficacy to the organism. From these findings we selected as a standard dose 30,000 units administered every three hours, continuously—this dosage to be used in furthering our studies and experiments in the treatment of Vincent's infection.

METHOD AND RESULTS OF STUDY

The following report shows our findings in the treatment of 125 cases of acute and subacute Vincent's infection at Barnes General Hospital, Vancouver, Wash. These studies were made from June 1944 to December 1945.

Group A consisted of thirty-five cases admitted to the hospital. The clinical diagnosis was confirmed by making a microscopic examination of a fresh smear taken directly from an ulcer or from the septic contents of a peridontal pocket. Cultures were taken for each patient to exclude all other pathogens and to eliminate the possibility of hemolytic streptococcus infection, the clinical appearance and subjective symptoms of which often resemble Vincent's infection and which is frequently treated as such. In this group no local or supportive treatment was given. We advised against the use of toothbrush and mouth irrigations; no special diets were prescribed and unlimited smoking was permitted during the administration of the drug. Patients were all hospitalized and confined in order that directions would be followed and to enable close observation of the patient. Penicillin was administered intramuscularly in doses of 30,000 units every three hours, continuously, twenty-four hours a day. Smears were examined every twelve hours. For a period of seven days after the microscopic findings for Vincent's organisms were reported as negative, mild prophylactic treatments were given, consisting of removal of all calculus, cleaning of teeth, removal of focal areas such as unerupted third molars and the temporary repair of carious teeth. Mouth hygiene was stressed. After this seven-day period there was no clinical evidence that the disease had recurred and there were no microscopic findings of Vincent's organisms. The average time required to produce a negative smear for Vincent's organisms by the administration of penicillin was thirty-six hours. The average total dosage of penicillin per patient was 360,000 units. There were no failures.

Group B consisted of thirty-eight cases admitted to the hospital. The clinical picture was confirmed and cultures were taken, using the same procedures as in Group A. This technic was also carried out in Groups C and D. Penicillin was administered intramuscularly in doses of 30,000 units every three hours, continuously twenty-four hours a day. During the administration of the drug, local treatment to the affected structures was instituted. This treament consisted of the removal of heavy calculus, cleansing of the septic pockets, temporary repair of all carious teeth and the treatment of focal areas such as unerupted third molars, with their subsequent removal. One of the following drugs was applied to the affected areas once daily: gentian violet crystals, chromic acid 7 per cent, Fowler's solution with hydrogen peroxide, zinc peroxide or sodium perborate. Special diets were prescribed for their high vitamin C content; cigaret smoking was prohibited or held to a minimum. Oral hygiene in all cases was definitely improved. Seven days

after the smears were first reported negative for Vincent's organisms, and penicillin had been discontinued, another microscopic examination was made to check recurrence. During this period, local treatment was applied when it was felt the clinical picture warranted such treatment. The average number of hours penicillin was administered was forty-two and one-half. The average total dosage of penicillin per patient was 425,000 units. There were no failures.

Group C consisted of thirty patients who were not hospitalized. These patients were allowed to remain on full duty during the course of treatment. In this group it was our aim to establish a treatment for the ambulatory patient by the administration of penicillin with the thought that it could be used by the doctor in his office practice. Thirty thousand units of penicillin was administered every three hours, continuously for three doses daily, making the maximum daily dose 90,000 units. During the administration of the drug and through the seven-day waiting period the same local treatment was applied to the patients of this group as to those in Group B. At the end of the seventh day, after the discontinuance of penicillin, microscopic findings revealed a moderate number of Vincent's organisms in four cases. The average number of hours penicillin was administered was seventy-five, or three plus days. The average total dosage of penicillin per patient was 270,000 units. There were four cases of failure, or 13 per cent of the total number of cases treated in this group.

Group D consisted of twenty-two patients, not all of whom were hospitalized. Prophylactic treatment of this group was stressed. All gross tartar was removed. Carious teeth were filled and overhanging fillings were removed. Instruments were passed into each gingival crevice throughout its entire circumference for the purpose of emptying it of its septic and irritating contents and in order that penicillin could be instilled more readily. Focal areas of infection were given special attention. Patients were instructed in proper mouth hygiene. No other medication was used in this group except a concentrated solution of penicillin applied topically three times daily. This solution was prepared by dissolving 200,000 units of penicillin in 4 cc. of sterile distilled water. The mouth was carefully dried by air and thoroughly packed with sponges to maintain dryness. Penicillin was carried to all lesions and into all gingival crevices and periodontal pockets by the use of a Luer lock syringe using a 25 gage needle with a blunt point. The drug was kept in direct contact with the tissues involved by applying it almost constantly for five minutes at each sitting. During the seven-day period the same prophylactic treatment was given this group as was given Groups B and C. The average number of days necessary to produce negative microscopic findings for Vincent's organisms was six plus. The average total dosage was not known. There was failure in three cases, or 13 per cent of the total number of cases treated in this group.

COMPARATIVE THERAPEUTIC RESULTS

In Group A, where no supportive treatment and no attention to mouth hygiene was given until after the smears were reported negative for Vincent's organisms, we were able to produce clinical evidence of a marked improvement in both the subjective and objective symptoms after twenty-four hours of penicillin therapy. In this group, the average time required to produce a negative smear for Vincent's organisms was thirty-six hours; the average total dose per patient was 360,000 units.

In Group B, supportive measures, consisting of the various drugs heretofore mentioned and prophylactic treatment, were used at the time penicillin was administered. There was no clinical evidence of appreciable improvement of this group over Group A. The average time required to produce a negative smear was forty-two and one-half hours, or an additional six and one-half hours over Group A. The average total dose per patient was 425,000 units—an increase of 65,000 units over Group A.

In Group C, penicillin was administered in doses of 30,000 units, continuously, three times daily or a maximum daily dose of 90,000 units. Supportive treatment was the same as that given to Group B. The average number of hours penicillin was administered was seventy-five, or an increase over Group B of thirty-two and one-half hours and an increase over Group A of thirty-nine hours. Although the total number of hours penicillin was administered was greater than for the two previous groups, the average total dose per patient was reduced to 270,000 units. We reported four failures, or 13 per cent of the total number of cases treated in this group. This group differed from Groups A and B in that those groups had no failures.

In Group D, penicillin was applied topically three times daily to the affected structures. Supportive treatment, consisting of prophylactic procedures, was stressed and no other drug was used. The average total dosage could not be definitely determined. It was necessary to administer the drug 150 hours (six plus days) in order to effect a cure. We reported three failures, or 13 per cent of the total number of cases treated in this group.

COMMENTS

1. Penicillin injected intramuscularly or applied topically, acts as an efficacious spirocheticide.

2. Microscopic examinations of smears taken from the mouths of patients suffering from Vincent's infection and who were treated with penicillin, either intramuscularly or topically, showed a progressive decrease in the fusospirochetal organisms. This decrease was markedly more progressive after intramuscular administration.

3. In the group where supportive treatment was given in conjuction with the administration of penicillin the clinical symptoms did not improve as rapidly during the administration period as was the case in the group where

no supportive treatment was given. We observed in approximately 71 per cent of our patients a marked increase in salivation immediately after the administration of penicillin. This fact may be explained according to Best and Taylor,[4] in that salivary secretions can be influenced by excitation through either the medium of the nerves or by chemical means such as drugs and abnormal metabolic substances which reach salivary cells through the blood stream. According to Florey,[5] when penicillin was administered intramuscularly it was found in the body fluids—saliva, blood and bile. With this knowledge we may deduct that with increased salivation there is an increase in the amount of penicillin secreted by the saliva in a given period of time. We were able to produce a negative microscopic smear in a shorter time in the group where no prophylactic treatment or other therapeutic agents were used. This might best be explained in that the presence of débris and calculus around the teeth are an aid in increasing the effectiveness of penicillin, acting as an absorbent medium for the drug, and in that the abnormal amount of saliva present probably has some therapeutic value and is more beneficial to the patient than mouth irrigations.

4. Penicillin can be administered by the dentist in his office, using 30,000 units as a standard dose, every three hours, continuously, three times daily. Although the total number of hours necessary to produce a negative finding was greater, the total dosage was less. This would tend to substantiate the finding of various other writers, that penicillin is rapidly eliminated through body excretions thereby lowering the penicillin content of the blood and the saliva, necessitating a longer period of time to effect a cure.

5. The topical application of penicillin in conjunction with prophylactic measures did not improve the subjective or objective symptoms nor were we able to produce a negative microscopic smear as rapidly as when the drug was administered intramuscularly. Penicillin, when applied topically, must be brought to and maintained in contact with the organisms in order to produce best results. When the drug is administered in this way it eliminates the discomforts and inconvenience of injection but the time necessary to effect a cure is longer, thereby allowing the primary host more time to continue its damaging effect to the gingival tissue.

6. Penicillin does not produce any serious toxic effects. A few of our patients under treatment complained of a mildly upset stomach and a loss of appetite after prolonged administration. The drug apparently has a beneficial effect on the gingival tissue, producing rapid healing, less tendency to bleeding and an unusually good tissue tone. The gingival tissue continues to improve in the presence of unfavorable local conditions. In

4. Best, C. H. and Taylor, N. B.: Physiological Basis of Med. Practice. Baltimore: Williams and Wilkins Co., 1939. Second Edition, p. 674.

5. Abraham, E. P., Florey, W. H., Chain, E., Fletcher, C. M., Gardner, A. D., Heatley, N. G. and Jennings, M. A.: Further Observation on Penicillin. Lancet. 2:177, 1941.

many instances the improvement was so marked that it was suggestive of local treatment in that septic pockets were sometimes completely free of their contents. The effects of the caustic drugs sometimes used—which destroy the interdental papilla, thereby opening avenues for secondary infection such as periodontal diseases—can be eliminated by the use of penicillin in the treatment of Vincent's infection.

7. In review of our statistical findings, a failure rate of sufficient importance to suggest further study was observed in two of the groups. The patients in these two groups appeared clinically cured but our microscopic findings showed the presence of a moderate number of Borrelia vincenti and fusiform bacilli. The recurrence of the infection might be explained by the walling-off of the organisms. This could occur in extensive periodontal pockets and in pericoronal infections. It is important that a careful search be made for these areas and their eradication effected, if possible.

8. Our findings have shown that when penicillin is administered intramuscularly in sterile distilled water it is an effective agent in the treatment of Vincent's infection. However, Romansky[6] describes a method of intramuscular administration in a beeswax and peanut oil mixture which decreases the rate of absorption, prolongs the duration of an effective level in the blood and is of a minimum inconvenience to the patient. This method would be of great importance in the treatment of Vincent's infection, provided the drug, when administered in this medium, does not decrease the abnormal flow of saliva which we assume is most beneficial. —*211 Medford Building.*

6. Romansky, Monroe J., and Rittman, George E.: Penicillin. U. S. Army Bull. 81:43, October 1944.

RECENT REVIEW AND DISCUSSION OF PENICILLIN

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CRYSTALLINE PENICILLIN

A new crystalline penicillin is now available which does not require refrigeration and which when dissolved in saline solution is much less painful during injection than previous penicillin preparations have been. Its potency is measured on the basis of exact weight and represents the first penicillin whose exact potency is known. The duration of its potency in the dry state is as yet unknown but it is fair to assume that because the compound is crystalline it will have the same stability as all ordinary chemical compounds. It can be predicted that in the near future all preparations of penicillin to be marketed will be of a crystalline nature.

TECHNICS FOR PROLONGING THE ABSORPTION PERIOD OF PARENTERAL PENICILLIN

Beeswax with peanut oil has been known for some time as a vehicle for prolonging the time required for absorption of parenterally administered penicillin. This retardation permits therapeutic blood levels, capable of combating most common severe infections, to be established within an hour and maintained for from sixteen to twenty-four hours or longer. The difficulty in its administration, however, arises from the fact that should any moisture come in contact with the penicillin-beeswax-oil mixture, crystallization of the penicillin takes place and mechanical difficulties in the injection procedure are created. This difficulty has been overcome by providing penicillin-beeswax-oil mixture (Romansky formula) in a sterile cartridge-type disposable syringe. With this unit no sterilization of needle or syringe is required, the possibility of the presence of moisture is eliminated and injections can be made rapidly. This preparation of pencillin is supplied only as 300,000 Oxford units per cubic centimeter in individual cartridge type syringes. Present practice is to administer one injection in twenty-four hours for acute gonorrhea and this constitutes complete treatment and cure in more than 95 per cent of patients. For infections such as pneumococcus pneumonia, various hemolytic streptococcic infections and meningicoccal infections, one injection is given every twenty-four hours for as long as required. This mixture is not adapted for infections such as subacute bacterial endocarditis or other diseases in which prolonged therapy may be required. It has been used experimentally in the treatment of early syphilis and present reports indicate that it is almost if not equally as efficacious as saline solutions of penicillin injected every four hours.

ORAL PENICILLIN

Buffered Penicillin Tablets.—Experiments taking place throughout the country are proving that it is unnecessary to buffer penicillin tablets to be administered by mouth. The blood levels obtained with unbuffered penicillin are identical with those obtained with any of the numerous buffered tablet preparations now available. Apparently the gastric juice has much less of an inactivating influence than was formerly thought to be true. The Committee on Chemotherapeutics and other Agents of the National Research Council has as yet not permitted manufacturers to omit buffer, but in all probability will do so within the near future. Several manufacturers of penicillin have buffered tablets in experimental dosage available for distribution upon request.

Dosage of Penicillin Tablets.—When oral penicillin is administered, it should be given in doses five times greater than the amount that would be injected. This will produce penicillin blood levels identical with those obtained with parenteral therapy. This is not to say, however, that oral penicillin can be or should be substituted at will for injection therapy. Present recommendations confine the use of oral penicillin in the five to one ratio to the less severe infections caused by the more penicillin-sensitive organisms and to those conditions in which past experience has proved that parenteral therapy will not be required for prolonged or intensive treatments.

NEW METHODS FOR ADMINISTERING PENICILLIN

Aerosol Penicillin.—Aerosolization of solutions of penicillin by means of a nebulizer has been used with dramatic success in the treatment of various pulmonary infections including pneumonia, acute bronchitis, acute and chronic bronchiectasis and pulmonary abscess and for prophylaxis before and after operations on the lung for both bronchiectasis and pulmonary abscess. Tremendous concentrations are obtained within the alveoli by this method when pressure to drive the aerosolized penicillin is obtained by either oxygen or steam under pressure. Penicillin can be absorbed into the blood stream through the alveolar membrane when administered by this method so that apparently both systemic and local effects are obtained. This method of administering penicillin may be of interest in dentistry when the accidental aspiration of infected material from the oral cavity occurs.

Where intense local concentrations of penicillin are desired in the bronchial tree, penicillin may be instilled supraglottally, directly with a canula attached to a syringe, in a technic similar to that used for the supraglottal installation of lipiodol for bronchography.

Penicillin Suppositories.—Since penicillin acts directly on infected mucosal tissues it has been incorporated in suppositories for use in gyneco-

logic infections, especially those of the lower generative tract, such as cervicitis and endocervicitis. Its use in juvenile vaginitis caused by the gonococcus is to be anticipated.

PENICILLIN TOXICITY

Despite the enormous quantities of penicillin that have been administered in large doses and by various methods, the reports of true toxicity to the drug are singularly infrequent. The commonest side effects (and these hardly may be called true toxic reactions) are urticaria, chills and fever. It has not been determined whether these reactions are caused by impurities in penicillin preparations or represent a hypersensitivity on the part of the person receiving the antibiotic, or whether both factors are responsible at different times. It is generally felt that if penicillin is indicated, its administration should be continued in spite of the development of urticaria, although a change of brand should be made. An occasional case of severe serum sickness, angioneurotic edema or eczema has also been reported.

Side reactions to oral penicillin tablets (buffered) have been reported and include cramps, nausea, vomiting and diarrhea, the latter occasionally being severe. It is generally felt that these side effects are not caused by the penicillin of itself, but by the buffers that are incorporated with the drug. When penicillin is applied topically to the skin and mucosal surfaces, side reactions may also occur. The use of penicillin lozenges has resulted in various types of acute lesions of the mouth which subside promptly with discontinuation of the drug.

Solutions and ointments of penicillin applied to the eye have likewise caused irritation. These are undoubtedly allergic or hypersensitivity reactions. A curious reaction to penicillin that was administered parenterally has been noted in patients suffering with fungus infections of the skin. Such lesions, especially when present in the groin (tinea cruris) and on the feet (epidermitophytosis), have flared up during administration of penicillin for a number of infections for which it is commonly used.[1]—*55 East Washington Street.*

1. Cormia, F. E.; Jacobsen, L. Y., and Smith, E. L.: Reactions to Penicillin. Bull. U.S. Army M. Dept. 4:694 December 1945.

COMPOUND COMPOSITE ODONTOMA OF THE MANDIBLE: REPORT OF CASE

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History.—A well-developed and well-nourished young lady, aged 23, was referred to me on account of the absence of all molar teeth on the lower right side coupled with no history of any extractions.

Examination.—Roentgenographic examination (Fig. 1, left) disclosed a large odontoma consisting of oddly formed teeth with one normal molar which was lying on the lower border of the mandible. The patient had no discomfort from this tumor. The absence of teeth in the lower right area and the elongation of the upper molar on the right side were the only reasons for taking the roentgenogram.

Operation.—The patient was hospitalized, given premedication of 1/6 grain morphine, 1/150 grain atropine and general anesthesia of gas and ether. The entire tumor was removed. Although the postoperative roentgenogram (Fig. 1, right) may appear as a fracture, this was not the case. The tumor contained 66 teeth which were accounted for and a few very small ones that were lost through the tip of the aspirator. The most interesting part of this operation was the discovery that the lingual portion of the mandible was unusually well developed and gave substantial support without danger of fracture and an excellent area from which bone could regenerate. The cavity was filled with sterile vaseline gauze and the incisions were sutured. Dressings were changed twice a week, the area was irrigated with warm 50 per cent solution of hexylresorcinol and the dressings were replaced for a period of two and one-half months until regeneration of new tissue was well established.

Postoperative Course.—The postoperative course was uneventful. The patient had a slight amount of swelling for ten days but very little postoperative

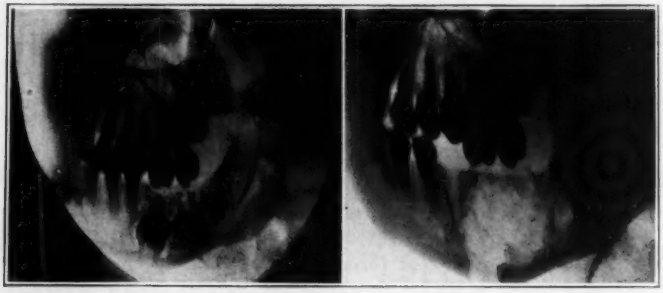

Fig. 1.—Left: Roentgenogram showing compound composite odontoma of the mandible and the marked extrusion of the upper first and second molars owing to the lack of functional occlusion. Right: Postoperative roentgenogram of the region of the removed tumor.

pain. She was able to resume her work in two weeks and pursue her normal routine.

Conclusion.—A postoperative roentgenogram (Fig. 2) taken June 3, 1946, approximately one year following the operation, shows the complete regeneration of the mandible in this area. The only disappointment was the fact that the tumor was not discovered at an earlier age. The elongation of the patient's upper molars prevented the possibility of any replacement being made in this area except by their extraction. This case substantiates my belief that, when there is a history of no loss of teeth, all areas that appear edentulous should be radiographed to determine whether or not there is a pathologic condition or abnormal development.—*258 Genesee Street.*

Fig. 2.—Roentgenogram taken one year after operation showing complete regeneration of the mandible. It is obvious that, had examination been made to determine the reason for the noneruption of the first molar, the condition could have been diagnosed and a great deal accomplished to obviate the restorative problems incident to the delay.

INTRA-ORAL SURGICAL REDUCTION OF FRACTURE OF THE MANDIBLE AFTER FAILURE TO CORRECT THE DISPLACEMENT BY ELASTIC TRACTION: REPORT OF CASE

HENRY B. CLARK JR., M.D., D.D.S., St. Paul

The principles of surgical open intra-oral reduction by refracturing are here illustrated. The method of gradual reduction by intermaxillary elastics had been applied elsewhere. This was one instance where it had failed.

REPORT OF CASE

History.—A white soldier, aged 26, was injured about the face in a vehicle accident in central Italy, September 18, 1944. He did not lose consciousness but was somewhat dazed for two or three days after the injury. He was given early treatment at a nearby station hospital and arrived at the Fifty-second Station Hospital September 22, 1944.

Physical Examination.—Three small lacerations of the face had been sutured and were healing well. The same was true of a 1 cm. tear on the inner surface of the lower lip.

Intra-oral examination revealed that continuous loop wiring had been placed on the upper and lower teeth with elastic traction in place. However, the occlusion was bizarre, giving an effect of prognathism in the lower right anterior region. Mobility was demonstrated here and it was evident, after study of the roentgenograms, that a long, oblique, splintering fracture existed. However, it was not possible by gentle manipulation without anesthetic either to reduce the fracture or to determine exactly how it would be necessary to manipulate in order to accomplish the result.

The patient had very irregular dentition and the dental attendant considered rather seriously that possibly the present occlusion would be satisfactory for the patient. The dental attendant reasoned that since the gradual force of elastic traction had not reduced the fracture in four days, it must be indeed impacted or a very unusual fracture which would strongly resist attempts at reduction under an anesthetic. As a consequence, eight days passed before the surgical reduction, under anesthetic, was performed.

Laboratory Findings.—Copper sulphate: hematocrit 43, hemoglobin 15.5 gm. Urinalysis: negative.

Roentgenographic Examination.—A single complete fracture of the mandible was seen. It extended from the midline, superiorly, to the right second bicuspid, at the lower border. The fragments were displaced and overlapping (Fig. 1).

Treatment and Course.—On September 23, the patient was up and about, feeling well. He was using hot saline mouthwashes hourly. He was not receiving sulfonamide therapy. Interdental wiring and intermaxillary fixation with elastics were being maintained.

Operation.—On September 25, under gas, oxygen and ether intratracheal

Fig. 1.—View of occlusal plane of mandibular fracture before surgical reduction.

anesthesia, the elastic bands were removed and a vigorous effort was made, with digital manipulation, to disengage the fracture and replace the fragments in proper position. This was not possible although considerable movement was present at the fracture site. Accordingly, with scalpel and chisels, the entire fracture line was opened up and the firm fibrous attachments were severed. Not until the last of these bands had been divided was it possible to separate the bone ends with strong traction on each. It was then clearly seen why the fracture had not become reduced under steady intermaxillary elastic traction. One of the bone ends had a blunt point and the other had a corresponding recess; but a locking effect had occurred which held them in the abnormal position. The proper reduction was achieved and the resulting occlusion instantly appeared to be obviously normal for the patient. Two slender interdental wires were placed, extending across the fracture line (Fig. 2), simply to hold the ends together gently until intermaxillary fixation could be re-established on the patient's return to consciousness. Three mucosal sutures were placed to close the wound loosely.

Course.—Intermaxillary wires were placed in the evening of September 25 after the patient had recovered full consciousness. Occlusion was excellent. The patient received sulfadiazine 4.0 gm. daily. On September 28 it was noted that very little swelling and reaction had followed the operation. The occlusion was correct. The patient was taking a liquid diet well. On September 30 the patient was doing well. Sulfadiazine was discontinued. Hourly hot saline washes were used. Recovery was uneventful and intermaxillary fixation was still being used on October 15. The tie wires were replaced with

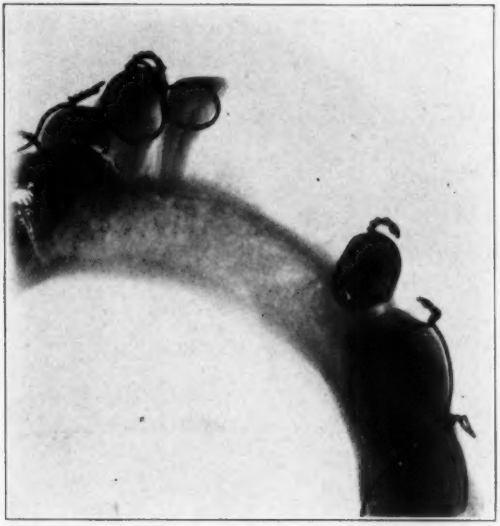

Fig. 2.—View of occlusal plane of fracture after reduction.

elastic bands. Intermaxillary elastics were removed on October 30. There was no mobility at the fracture site. The patient was placed on a soft diet. Interdental wiring was removed on November 2 and the patient was placed on a regular diet. On November 8 a partial denture was inserted to replace the missing lower teeth. The patient was discharged to full duty on November 10.

Diagnosis.—1. Lacerated, mild, generalized wounds of the face. 2. Severe, compound, complete, impacted fracture of the mandible into the mouth, from the midline to R-13 area, with malposition.

COMMENT

The general rule that the application of interdental wiring and intermaxillary elastic traction will gradually draw the teeth into occlusion applies quite well in most cases of fracture of the mandible. This case was an exception because the fragments were lodged or locked and failed to be reduced by the method just mentioned and began to be united in the abnormal position.

The significant thing was that after the passage of only eight days, the early stages of callus formation, or fibrous union, had progressed so far that nothing short of surgical severance was adequate to mobilize the fragments sufficiently to reduce the displacement.

Although one case is not enough upon which to base a general rule, here at least is one instance in which time was a factor in the matter of ease of reducing a mandibular fracture. If malposition with early fibrous union is encountered, this case would indicate there should be no hesitation to operate intra-orally to correct the defect, before continuing fixation in the usual manner.—*1132 Lowry Medical Arts Building.*

STABILIZATION OF FRAGMENTS OF AN EDENTULOUS MANDIBLE SHOWING EXTENSIVE LOSS OF BONE: REPORT OF CASE

HENRY B. CLARK JR., M.D., D.D.S., St. Paul

The problem in this case was to stabilize fragments of an edentulous mandible in which a large bone gap existed, the result of mutilation by artillery shell fragments.

Stabilization was accomplished by the construction of an acrylic denture-like splint, without teeth, which was secured to the mandible by three circumferential wires.

REPORT OF CASE

History.—A white officer, aged 25, was hit by enemy artillery shell fragments on September 16, 1944, in northern Italy. He sustained wounds of the face, jaws and left upper arm. He was taken to the Ninety-fourth Evacuation Hospital for débridement and primary closure of the face wounds and closure of the rent in the oral mucosa. The arm wound was also débrided. He was admitted to the Fifty-second Station Hospital on September 25, 1944.

Physical Examination.—The patient was up and about. He felt well and had no complaints other than of difficulty in talking and eating. He had no wires or appliances on his teeth. Healed, nicely-sutured lacerations of the face were evident. There was visible flattening in the region of the right angle and body of the mandible. Intra-oral examination revealed free movement in the left anterior mandibular region owing to a large bone gap. The oral mucosa had been sutured across to close the intra-oral defect. Many teeth were shattered and splintered. None had apparently been extracted after the patient was wounded.

In the left deltoid region a 1 cm. metallic foreign body could easily be felt within the healed wound.

Laboratory Findings.—Copper sulphate: hematocrit 40, hemoglobin 15 gm. Urinalysis: negative.

Treatment and Course.—On October 17, 1944, the patient was operated on for removal of the metallic foreign body from the left arm. On October 28, the fractured teeth, L-1, 2, 3, 4, 5 and 6 and R-1 and 2, which could not be retained, were extracted by the attending dental officer. The alveolar process did not require trimming. On November 10, after consultation with other members of the staff, it was determined that bone grafting would not be done overseas but it was felt that some stabilization of the "floating" segments of the mandible could well be done. The construction of an acrylic splint would perform this function and if an upper splint were also made the patient would have a rest position for the jaws. It was planned to secure the lower acrylic saddle with circumferential wires so that it would have sufficient retentive power to retain the lateral segments in their proper relationship.

Fig. 1.—Roentgenogram showing acrylic upper and lower splints in place, the lower secured by three circumferential wires.

The patient was now virtually edentulous. Acrylic upper and lower splints were constructed by the attending dental officer on November 17, and tried in.

On November 18, the patient was given gas, oxygen and ether intratracheal anesthesia. The lower splint was placed in the mouth. Proper lateral relationship of the mandibular segments was verified so that they were held essentially in line with the upper ridges. Three doubled .016-inch stainless steel wires were inserted in the usual manner to serve as circumferential wires, gripping the saddle firmly to the ridges of the mandible. In the passing, a large curved abdominal skin needle was used. In each case the ends which presented in the mouth were grasped in either hand and sawed back and forth several times to snug the wires firmly against the lower border of the mandible and to cut through any interposed soft tissue. The ends were tightly twisted, cut and bent down. The upper splint was then inserted, but it was found that the patient would have difficulty in eating without a hole in the anterior portion of the splint for the passage of food. The upper splint was therefore not inserted at this time. The patient was returned to his bed in good condition.

On November 19, the upper splint, provided with a hole for the passage of food, was placed in the mouth. Retention was aided by the passage of two interdental wires in the upper right bicuspid area, giving a clutching effect when tightened, so that the upper piece was firm. The upper and lower acrylic splints were joined with elastic bands attached to buccal and labial hooks. There was rather severe pain in the region of the left circumferential wire on November 21, requiring morphine for relief and sleep. The wire was not unduly loose and it was felt that this pain, probably caused by periosteal irritation from the wire, would abate in a few days. On November 26, pain was much less severe. The wires remained firm and the splints were in place and functioning well (Fig. 1). By December 1, the patient was

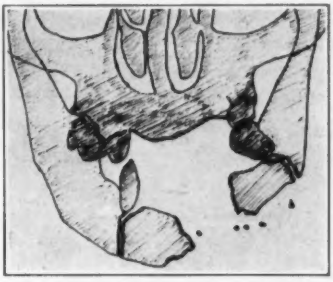

Fig. 2.—Sketch indicating extent of the bone gap.

very comfortable. Postoperative roentgenograms showed the wires to be in good position. The patient was evacuated to the United States for further care on December 5.

Final Diagnosis.—1. Severe, lacerated and penetrating wounds of the face, tongue, floor of mouth and lips.

2. Compound, comminuted fracture of the left body of the mandible, anteriorly, with severe loss of bone (Fig. 2).

3. Multiple fracture of teeth.

COMMENT

In this instance the early care in the evacuation hospital departed from the conventional teaching on these injuries but was, in our opinion, the best course to follow in this case. By what was no doubt a long and technically difficult procedure, the surgeon accomplished a nice closure of the surface facial lacerations in a layer closure after which he widely undercut the oral mucosa in order to repair the rent in the floor of the mouth. The patient was thus freed early of the need for facial dressings as there were no remaining open wounds. The remnants of the mandible were covered by soft tissue so that they did not continue to sequestrate fragments of bone as a result of contamination by saliva.

It is noteworthy that no effort was made in this primary operation to stabilize the lateral segments as is so often stressed in the texts. Theoretically, it would be expected that these segments would collapse toward the midline, giving a gross deformity. They did collapse slightly but this effect could be corrected immediately by slight lateral pressure with the index fingers because no massive scar had been allowed to form from wounds long left open. This prevention of scar tissue by closing wounds promptly would seem to be the greatest service that the oral surgeon can accomplish for the reduction and fixation of badly displaced fragments. Later bone grafting to restore gaps will of necessity require surgery in any event. It would be ideal if the gunshot fracture could be reduced properly and the soft tissues closed over the wound at one time, and very early. Unfor-

tunately this would require such long periods of surgery or would encumber a patient with so many appliances, sutures and dressings that it is not often practicable.

In the case of this patient it was clearly demonstrated that he was happy and comfortable. He is through with soft tissue surgery and all he needed at the time of his discharge to the zone of the interior was a bone graft and subsequently dentures.—*1132 Lowry Medical Arts Building.*

RANULA: REPORT OF CASE

HENRY B. CLARK, JR., M.D., D.D.S., St. Paul

History.—A white man, aged 23, presented with the complaint of a swelling in the mouth beneath the tongue. The swelling had been present for nine months, growing gradually larger, until at the time of the examination it interfered with eating and was becoming sore.

Examination.—Examination revealed a smooth, tense, almond-shaped swelling of the right floor of the mouth (Fig. 1, left), which was definitely fluctuant and quite discrete from other structures in that area. It was only slightly tender. It extended from the midline, immediately back of the lower incisors, posteriorly for 3 cm. The blood count and urinalysis were normal.

Operation.—On October 17, 1941, the patient was operated on for correction of what was preoperatively diagnosed as a ranula. Right mandibular and lingual nerves were blocked with a 2 per cent procaine solution. The anterior and posterior poles of the ranula were grasped with Allis forceps. The roof of the cyst-like structure was then completely excised by a circular incision. C Deknatel running sutures were placed so as to approximate the ranula lining and oral epithelium around the entire circumference. Thus the lower half of the ranula lining was made to become the new oral epithelium in that area.

Course.—The patient irrigated his mouth with warm saline solution every hour for the next few days. The sutures were removed on the sixth postoperative day and the patient was discharged on the seventh. When seen, one month later, recovery was complete (Fig. 1, right).—*1132 Lowry Medical Arts Building.*

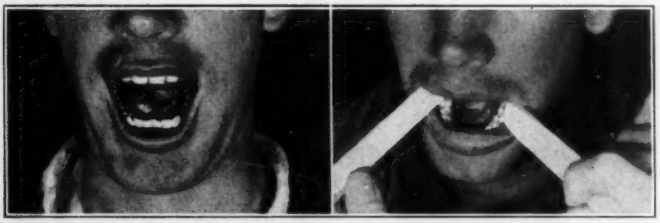

Fig. 1.—Left: Preoperative appearance of patient with ranula. Right: Postoperative appearance.

PRESENCE OF GLYCOSURIA IN DEEP POST-OPERATIVE SUBMANDIBULAR CELLULITIS: REPORT OF CASE

D. C. Foti,* D.D.S., B.S., New Orleans

History.—A white man, aged 19, presented himself at the Charity Hospital complaining of pain, general malaise and dysphagia. The patient stated that a lower second molar which had been aching for two days prior to its extraction had been removed under local anesthesia. The patient used toothache drops to alleviate the pain prior to his visit to the dentist. The extraction was made on February 16, 1946. That same night the left side of the patient's face began to swell, with accompanying pain and fever. The edema became more extensive as the hours passed. On the following day the patient returned to the dentist at which time he was given sulfathiazole 1 gm. every four hours. His condition became progressively worse and upon his return to the dentist he was referred to a physician who gave him 300,000 units of penicillin in doses of 50,000 units every two hours. When the patient's condition did not improve he was sent to the Charity Hospital for treatment on February 20, 1946.

Clinical Examination.—Objectively the patient presented extensive edema in the region of the left side of the mandible and neck. This edematous area extended anteriorly to the midline of the neck and posteriorly to just behind the angle of the mandible. Superiorly it extended slightly above the mandibular alveolar crest and inferiorly to the base of the neck. The involved area was reddish in appearance and quite painful to palpation. Intra-orally the mucobuccal tissues were highly inflamed from the lower left first molar back through the area of the third molar. This area was sore to palpation as was the floor of the mouth which presented only slight evidence of edema. The throat was slightly inflamed and a great deal of pain was experienced in swallowing. Trismus was present to such an extent that the patient could open the mouth only slightly. The saliva was very viscous. Subjectively the patient complained of great pain and difficulty in breathing and swallowing. On admission, the patient's temperature was 102.9° F. The pulse was 80 and the respiration 25.

Urine Examination:—On admission the following findings were recorded: sugar +4; albumin, negative; acetone, negative and specific gravity, 1.018. Findings disclosed by subsequent urine examinations are shown in Chart 1.

Blood Examination.—The Kline test was negative. The test for blood sugar showed 72 mg. per cent. After incision and drainage, a blood culture disclosed the presence of Streptococcus viridans. Some of the purulent material was found to be streptococcus viridans and a gram negative rod-shaped bacillus, which was viable, could not be identified. The results of subsequent blood examinations are shown in Chart 2.

*Intern in oral surgery, Charity Hospital, New Orleans.

CHART 1.—URINALYSIS

Date	Color	Reaction	Sp. Gr.	Alb.	Sugar	Acetone
2-20-46	Dark Amber	Acid	1.018	0	+4	0
2-21-46	Dark Amber	Acid	1.015	0	+2	0
2-23-46	Dark Amber	Acid	1.018	0	+1	0
2-24-46	Dark Amber	Acid	1.017	0	+1	0
2-25-46	Dark Amber	Alkaline	1.020	0	1	0
2-26-46	Dark Amber	Alkaline	1.018	0	0	0
2-27-46	Dark Amber	Alkaline	1.015	0	0	0

CHART 2.—HEMATOLOGY

Date	Hemoglobin gm. per cent	Red Blood Cells	White Blood Cells	Poly.	Immature Cells	Eos.	Bas.	Mon.	Lym.
2-20-46	79	5,900,000	18,000	78	1%	2%	0	2	17%
2-22-46	76	5,550,000	16,000	71	2%	2%	1	3	21
2-24-46	77	5,840,000	12,000	69	1%	2%	0	4	24
2-25-46	81	5,800,000	10,000	68	1%	1%	1	4	25
2-27-46	79	5,450,000	7,400	68	1%	1%	1	5	24

Physical Examination.—The examination of the patient was essentially negative.

Treatment.—The patient was given penicillin: 30,000 units as an initial dose and 20,000 units every three hours. At the same time, sulfadiazine was given, 2 gm. and sodium bicarbonate 2 gm. as the initial dose, with sulfadiazine 1 gm. and sodium bicarbonate 1 gm. every four hours day and night. Hot magnesium sulphate compresses were ordered to the left side of the face and neck constantly with warm peroxide mouth wash and warm saline mouth wash every hour. Fluids were forced to 3000 cc. and 1 grain of codeine phosphate was injected intramuscularly every four hours for pain. One thousand cubic centimeters of normal saline solution was given by infusion and followed with 1,000 cc. of 5 per cent dextrose in normal saline solution to which was added 40 units of regular insulin.

Course and Observations.—It was noted that from the time the patient was admitted, his condition became progressively worse. This was complicated with the difficulty in swallowing to such an extent that it was feared the patient might suffer respiratory failure. It was decided that the involved area should be incised and drained immediately. A consultation was called with an eye, ear, nose and throat specialist as to the advisability of performing tracheotomy prior to the necessary surgery. It was not deemed necessary.

Operation.—The patient was given ¼ grain of morphine and 1/150 grain of scopolamine as preoperative medication. A 2 per cent solution of procaine was injected intracutaneously at the site of the proposed incision. After drainage of the area, an iodoform pack and a pressure bandage were applied. The

following day at 11:30 a.m. the patient's temperature was 104.2° F., the pulse was 110, and the respiration 22. The preoperative orders were resumed immediately after the operation was completed at 3:30 p.m. The same day the temperature declined to 102.6° F. The edema was disappearing very rapidly. The following day at 8 p.m. the temperature was normal and most of the swelling had disappeared. The patient was greatly improved on the following day and was ready to be discharged to the clinic for final treatment, but was retained for two additional days, so that a glucose tolerance test could be made.

Blood Chemistry.—The blood sugar specimen which was taken prior to any medication was 72 mg. per cent. Other specimens subsequently taken were about the same.

The patient was subjected to a glucose tolerance test which presented a normal curve.

Comment.—The exceptional feature of this case is the fact that although the sugar content of the urine was + 4 at the time of the patient's admission, this condition became normal after the infection had subsided. It may be stated that the condition was transitory and was brought about only by the presence of the acute infectious process. This condition may be explained as due to a low renal threshold to glucose.—*Charity Hospital.*

IS BIOPSY OF NEOPLASMS DANGEROUS?

1. Rats bearing transplanted fibrosarcoma, adenocarcinoma, and squamous cell cancer were operated upon and compared with an unoperated upon control series for length of survival after transplantation and percentage in which metastases were detected.

2. The average survival period of rats bearing transplanted fibrosarcomas was significantly prolonged by excision of the tumor 9 days after transplantation but the percentage of lung and lymph node metastases was not altered.

3. The average survival period of rats bearing transplanted adenocarcinoma was significantly prolonged by the removal of a considerable mass of the tumor 60 days after inoculation. The rats operated upon which survived the rats of the control series had a significantly higher percentage of lung metastases.

4. A simple biopsy performed on rats bearing transplanted adenocarcinoma did not affect the average survival period of the rats or increase the percentage with lymph node and lung metastases.

5. A simple biopsy of transplanted squamous cell cancer did not affect the average survival period of the rats or increase the percentage of metastasis to the lymph nodes, lungs, and skeletons.—*Mann and Dunning, in Surg., Gynec. & Obst. 82: 572, May 1946.*

FATAL TETANUS ASSOCIATED WITH ACUTE MAXILLARY SINUSITIS

ADRIAN O. HUBBELL, D.D.S., Long Beach, Calif.

History.—A white woman, aged 50, was referred to my office by a general practitioner of dentistry for the removal of an upper bicuspid tooth. The patient reported pain in the right maxillary molars and also complained of pain and soreness in her back. This latter she attributed to recent gardening.

Examination.—Examination of the mouth revealed a well kept, well restored mouth with no evident caries or pyorrhea. Roentgenograms of the mouth were negative. The upper right bicuspids and molars were quite sensitive to percussion, especially the second bicuspid which carried a large inlay. All of these teeth were vital to the pulp test.

Transillumination of the sinuses showed a dark right maxillary sinus. The patient complained of difficulty in swallowing, but no cause was evident at the time.

Diagnosis.—A diagnosis of acute right maxillary sinusitis was made and the patient was sent to an ear, nose and throat specialist for treatment.

Treatment.—The right maxillary sinus was irrigated and a large amount of yellow pus was obtained. The pain in the teeth was immediately relieved.

Course.—The following day I was called to the home by the patient's husband because of the patient's increased difficulty in swallowing, pain in the teeth and some trismus. The back pain was slightly more annoying. Because of the many confusing symptoms, apparently unrelated, it was decided to hospitalize the patient for a routine physical and laboratory examination by an internist. This examination was negative. The possibility of tetanus was dismissed at that time because there was no lesion on the body. Within twelve hours following the patient's admission, the trismus became complete and regular contractions of the muscles of the neck began. Anti-tetanus serum was given and administered again in two hours. By this time tetanic convulsions had become general and were occurring every three minutes. The patient died twenty hours after admission to the hospital.

Conclusion.—Tetanus has been reported where it is believed the organism's entrance to the body was by way of the gastrointestinal tract, possibly through some defect such as an ulcer or fissure. The only other possibility suggested was that of a small healed lesion on the hands or feet which had healed before the tetanus spore became active.—*308 Security Building.*

BILATERAL OSTEOTOMY FOR RETRUSION OF THE MANDIBLE: REPORT OF CASE

JOHN J. STETZER JR., D.D.S., Philadelphia

History.—The patient, a white man, aged 21, was a grotesque appearing individual. He had a facial deformity and marked difficulty in speaking. Atrophy of the skeletal muscles of the right side affected his gait and movements of the hand. The mother stated that during the last months of pregnancy she was quite ill with influenza and that the patient was born two months prematurely. Apparently there was some cranial injury at birth. The mother stated that she noticed the deformity of the mandible at that time. The patient experienced the usual childhood diseases and diphtheria. Otherwise his past medical and family history were not significant.

Examination.—Oral examination revealed a marked retrusion of the mandible (Fig. 1). Almost a full complement of teeth was present although many were malposed, with the anterior maxillary teeth protruding. There was scarcely any occlusion of the opposing teeth.

Two cast silver splints were made and cemented over the crowns of the maxillary and mandibular teeth three days prior to hospitalization.

Operation.—On February 14, 1940, under avertin and nitrous oxide-oxygen anesthesia, a bilateral osteotomy of the rami of the mandible was performed. After the patient was anesthetized and the skin was prepared, a silk suture was passed through the tip of the tongue in the midline and a hemostat fastened to the free ends, the suture being long enough for the anesthetist to hold it away from the surgical field. This prevented the possibility of the tongue falling back

Fig. 1.—Left: Preoperative photograph of profile showing retrusion of the mandible. Right: Preoperative roentgenogram showing lateral view.

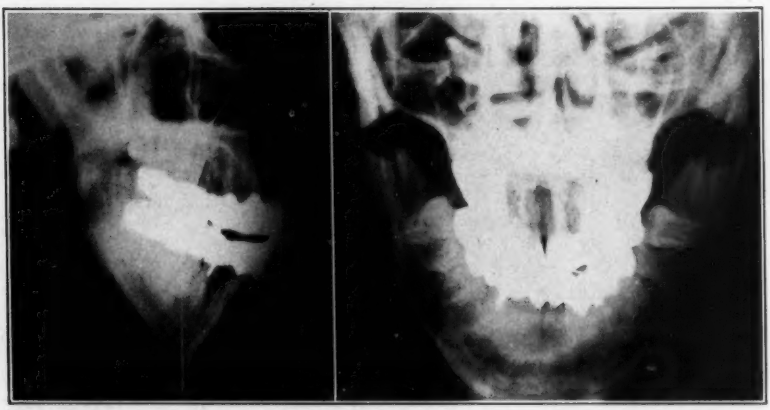

Fig. 2.—Left: Lateral roentgenogram taken on second day after operation, showing osteotomy of both rami. Right: Antero-posterior roentgenogram taken on second day after operation, showing both rami severed above the mandibular sulci.

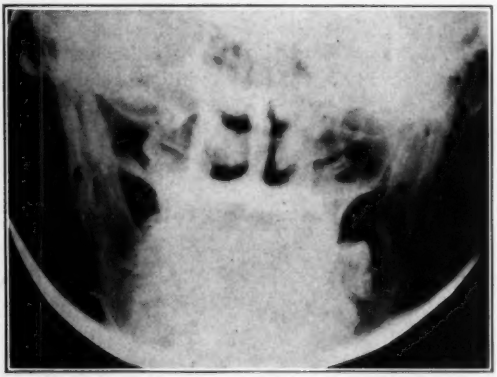

Fig. 3.—Antero-posterior roentgenogram taken twenty-four months postoperatively, showing both rami completely ossified.

into the pharynx and hindering respiration. The suture was left in place until the patient had fully recovered from the anesthetic. An incision 2 cm. in length was made just below the tragus of the ear along the posterior border of the mandible. The underlying tissues were dissected, exposing the posterior border of the ramus. A curved pedicle needle was inserted through the incision to the inner aspect of the ramus. The needle was moved forward on a line above the mandibular sulcus to the anterior border and was brought through the cheek through a small stab incision. The Gigli saw was fastened by means of ligature wire to the eyelet in the end of the pedicle needle and was

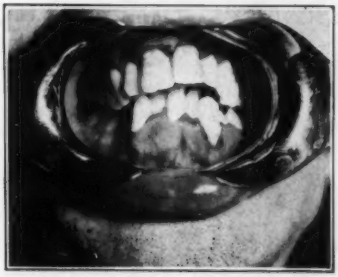

Fig. 4.—Photograph showing occlusion of the teeth two and one-half years after operation.

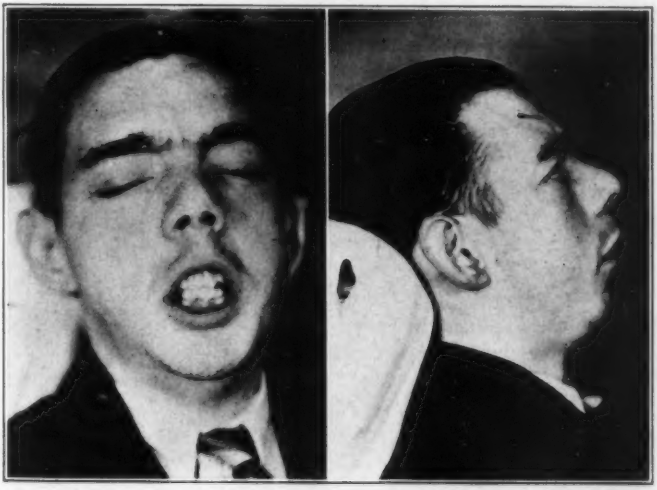

Fig. 5.—Left: Photograph taken one year postoperatively. The orthodontic appliances may be seen. Right: Postoperative photograph showing improvement in facial symmetry.

moved back and forth through the incisions. By this means the ramus was severed (Fig. 2). The incisions were closed with black silk sutures. The ramus on the opposite side was severed in the same manner. The mandible was then positioned into proper occlusion and held with wire ligatures to the splints.

Progress.—Ten hours postoperatively the patient complained of nausea and gagging. The wires were removed and loose elastic traction was applied to the splints, thus relieving the condition. The elastics were allowed to remain for eighteen hours after which wires were reapplied. I believe the trouble in this case was caused by the forward muscle pull which tensed the superior constrictor of the pharynx. After the jaws were tightened again the patient

experienced no further discomfort. He was discharged from the hospital in five days. The wounds were healing uneventfully. The jaws were held in this fixed position for almost eight weeks after which elastic traction was applied. At this time the patient was referred for orthodontic treatment.

I last saw this patient in February 1946. At that time he was holding a responsible position with confidence and self-assurance, and was in excellent health. His masticatory function and occlusion were quite good and his speech was more distinct.

Comment.—Surgery plus orthodontic treatment made a marked improvement in this boy's facial appearance (Figs. 4 and 5), as well as in his mental outlook. The sincere gratitude expressed by the patient and his mother and the improved mental attitude more than compensated the surgeon for his troubles.—*Nineteenth and Spruce Streets.*

OSTEOGENIC SARCOMA

The roentgenographic interpretation of bone tumors is properly a study of patterns of neoplastic activity and the character of the stromal response; a kinetic rather than a static concept. The roentgenologist can determine with a high degree of accuracy the benignancy or malignancy of a given lesion. Further differential diagnosis of tumor types by radiographic methods must be regarded as speculative. Metastatic lesions may simulate perfectly the appearance of primary sarcoma of bone. Microscopic study of tissue obtained by open biopsy remains as the most essential single diagnostic method in tumors of bone. Ewing's sarcoma (endothelial myeloma) is a notable exception, for in tumors presenting suggestive evidence of this lesion, a therapeutic test with small doses of x-radiation is a valuable diagnostic aid. In general, formal biopsy of bone tumors should precede the institution of any therapeutic program, either surgical or radiological. All reliable evidence fails to establish any hazard in open or needle biopsy of bone sarcomas. To employ intensive irradiation of bone lesions on roentgenographic evidence alone is an unwarranted intellectual obeisance to a fallible diagnostic measure.—*MacDonald and Budd, in Surg., Gynec. & Obst. 82:86, January 1946.*

OSTEOMYELITIS OF THE MANDIBLE: REPORT OF CASE

JOHN J. STETZER, JR., D.D.S., Philadelphia

History.—A white man, aged 48, a painter by occupation, was referred to our office for treatment on September 24, 1943. The patient presented himself with a moderate swelling of the chin, which was quite red and indurated, with extension of the swelling down the midline of the neck. It was quite obvious that he was experiencing pain and discomfort. Temperature was 100.8°, pulse rate 98, respiration 24 and blood pressure 120/85.

He gave a history of having the lower right second bicuspid tooth extracted about three months previously since which time he had had some discomfort in that area. In the mandible the only remaining teeth were the first bicuspids and all anterior teeth except the left lateral incisor. The maxilla was edentulous. One month after the extraction of the bicuspid tooth the patient went to another dentist for advice. Curettage of the area was suggested. According to the patient this was done with a dental burr under local anesthesia. There was little relief of pain following this procedure. Just ten days previously the patient returned to the same dentist for further curettement of the area. Pain became quite severe and definite swelling of the chin occurred. In forty-eight hours the patient returned, at which time the lower left second incisor was extracted to "relieve pressure." His condition became more serious and he was referred to us.

Examination.—The patient was admitted to the Oral Surgery Service of the Pennsylvania Hospital. The past medical history was not significant. The general physical examination was essentially negative. Urinalysis was negative for sugar and albumin.

Fig. 1.—Roentgenogram showing small sequestra separating on lingual side of the mandible in canine and bicuspid area.

Fig. 2.—Roentgenogram showing large sequestrum.

Oral examination revealed a small fistula on the lingual side of the bicuspid area. The edentulous areas had healed quite well. All of the remaining teeth appeared to be healthy except for a moderate amount of alveolar resorption about the incisors. The occlusal roentgenogram showed small sequestra on the lingual side of the mandible (Fig. 1).

Operation.—On September 28, 1943, after four days of general supportive treatment and sulfadiazine therapy, the patient was anesthetized with avertin supplemented with nitrous oxide and oxygen. A mucoperiosteal flap was raised from the lingual side of the right mandible. The three sequestra shown in the occlusal roentgenogram were removed. The pieces of bone were regular in outline and about 0.5 cm. square in size, obviously the internal cortical plate. Iodoform gauze was placed in the wound and the flap was returned and sutured. Recovery was uneventful and the patient was discharged from the hospital seven days after admission.

Progress.—During the ensuing month the dressings were changed every second or third day and the patient was kept on a maintenance dose of sulfadiazine. His general condition improved and he was much more comfortable. Three weeks following sequestrectomy, the submental area of his neck became indurated and tender. Clinical signs disclosed an abscess forming in the midline of the neck below the symphysis.

Second Operation.—On October 28, 1943, the patient was again admitted to the hospital. Under nitrous oxide-oxygen anesthesia a midline incision was made and the underlying structures were bluntly dissected until the abscess pocket was reached. A great deal of pus was evacuated. The symphysis of the mandible was roughened and soggy to the touch although none of the prominences had completely separated from the mass. A small gauze drain was inserted. Recovery again was uneventful, effecting discharge from the hospital in forty-eight hours.

Progress.—Drainage persisted externally for two and one-half months. Roentgenograms taken at that time revealed that sequestration was complete (Fig. 2).

Third Operation.—On the third admission to the hospital, January 12, 1944, the patient was anesthetized with avertin supplemented with nitrous oxide and oxygen. An incision was made just below the lower border of the mandible, con-

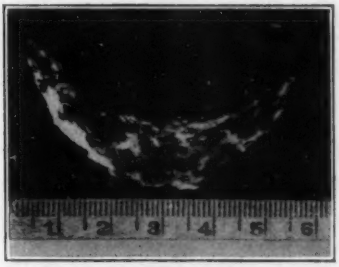

Fig. 3.—Photograph of the sequestrum removed.

forming to its outline and extending from one canine area to the other. After dissection of the underlying tissues a large sequestrum was removed (Fig. 3). It proved to be the entire lower border of the mandible from canine area to canine area, with the lingual plate attached. After its removal it was necessary to remove the attachments of the genioglossus and geniohyoglossus muscles from the genial tubercles of the sequestrum. The periosteal bed was packed with a liberal quantity of sulfanilamide powder and iodoform gauze. The fascia was sutured with oo chromic gut and the skin with interrupted black silk sutures. Convalescence was rapid and the patient left the hospital in four days. In two weeks the wound had healed completely.

COMMENT

I believe this case to be a striking example of what not to do in inflammatory conditions resulting from extraction of teeth. Pericemental infections and localized infections within an alveolar socket should first have adequate drainage and thereafter a watchful waiting course. Chemotherapy, the sulfonamides and penicillin, prevent or materially reduce the extension of the infectious process. In many instances the destruction of bone is aborted and if a sequestrum forms it is usually much smaller in size. Curettement and extraction of teeth in the early stages of osteomyelitis leads to extensive bone destruction of the entire jaw. This was certainly the cause of the patient's long illness. Early recognition of the disease, establishment of proper drainage, usually external, general supportive medication and diet and waiting until the diseased bone has completely separated from the healthy before any curettage or sequestrectomy is performed is the proper way to handle osteomyelitis of the jaws.—*Nineteenth and Spruce Streets.*

REDUCTION AND IMMOBILIZATION OF FRACTURE OF THE MAXILLA BY INTERNAL WIRE SUSPENSION: REPORT OF CASE

JOHN W. KEMPER, M.D., D.D.S., Ann Arbor, Mich.

History.—Five days before admission to University Hospital the patient was involved in an auto accident and suffered multiple facial injuries. He was given emergency treatment in a local hospital and referred to University Hospital for treatment of multiple facial fractures.

At the age of 5, the patient was treated at this hospital for multiple facial fractures. The rest of the past history was not significant.

Examination.—The patient was a well-developed, well-nourished white man, aged 24, suffering considerable discomfort from facial injuries. There was extensive edema and ecchymosis of the infra-orbital regions bilaterally with tenderness over the right zygoma. It was impossible to palpate any facial fractures.

Intra-oral examination revealed several lacerations of the buccal mucosa with gross oral sepsis of the partially edentulous mouth. The maxilla was freely movable in all directions with moderate inferior displacement. There was no evidence of injury to the mandible.

Blood and urine studies were negative.

Roentgenographic Examination.—Roentgenograms revealed transverse fracture of the maxilla extending through the maxillary sinuses at a point just above the root apices of the teeth. There was slight buckling, medially and posteriorly, of the right zygomaticofrontal suture. There was also a fracture of the right zygoma with no displacement. Both maxillary antra were clouded. The mandible and the cranial vault were intact.

Diagnosis.—Transverse fracture of the maxilla and fracture of the zygoma.

Treatment.—On the day after admission, an oral prophylaxis was given and a labial splint wire was adapted and ligated to the remaining maxillary teeth.

Two days later, under local anesthesia, a horizontal one-inch incision was made just along the inferior border of the orbit exposing the infra-orbital ridge on either side. The ridge was penetrated with a surgical bur at an angle of about 45 degrees. Through these holes on either side a 25 gage stainless steel wire was passed and carried down the anterior wall of the maxilla through the upper fornix of the vestibule of the mouth. The maxillary fracture was then reduced manually and immobilized by ligating the wires from the infra-orbital ridges to the maxillary splint wire (Fig. 1). The incisions were then closed with silk and dressed.

It was found that the maxilla was held very snugly in normal position with no demonstrable movement. Normal occlusion was re-established.

Because there was no deformity it was decided to do nothing with the other facial fractures.

Fig. 1.—Postero-anterior (left) and lateral (right) roentgenograms showing suspension and fixation of the fractured maxilla by wire ligatures extending from the labial bar to the inferior border of the orbit.

Postoperative Roentgenograms.—Good reduction of the maxillary fracture was revealed, as well as improved position of the facial fractures.

At the time of discharge on the fourth postoperative day the incisions on the face were healed and the patient was entirely comfortable. He was able to eat a soft diet without pain or movement of the maxilla. The patient was discharged in care of a state officer who returned him to prison. The attending physician was instructed to remove the suspension ligatures in two to three weeks by cutting them with small wire cutters inserted through the original skin incisions and withdrawing them into the mouth.

The patient returned after one year, stating that he had been unable to return as advised. At that time the wire fixation was still in place with no foreign body reaction of the soft tissues. The wire ligatures were removed under local anesthesia and the patient had normal occlusion and normal function. This illustrates well the tolerance of the tissues to buried stainless steel wire.—*Department of Oral Surgery, University Hospital and School of Dentistry, University of Michigan.*

OPEN REDUCTION OF FRACTURE OF THE MANDIBLE: REPORT OF CASE

JOHN W. KEMPER, M.D., D.D.S., Ann Arbor, Mich.

History.—Five weeks previous to admission to the hospital the patient was struck in the face by a piece of flying steel. He was stunned momentarily but recovered shortly and continued work. Except for slight swelling at the site of injury, persisting for several days, the patient was asymptomatic. It was not until some time later that the patient noted facial asymmetry on the left side. Roentgenograms revealed fracture of the mandible and the patient was referred for treatment.

The past history was essentially negative.

Examination.—The patient was a well-developed, well-nourished white man, aged 58, who did not appear acutely or chronically ill.

Just anterior to the angle of the mandible on the left side was a depression deformity along the inferior border. The mouth was completely edentulous. There was displacement intra-orally with an elevated posterior fragment which interfered with normal function on closing the mouth. There was no evidence of inflammation or suppuration.

The rest of the physical examination was not remarkable. Blood and urine studies were negative.

Fig. 1.—Preoperative roentgenogram of fracture of the edentulous mandible.

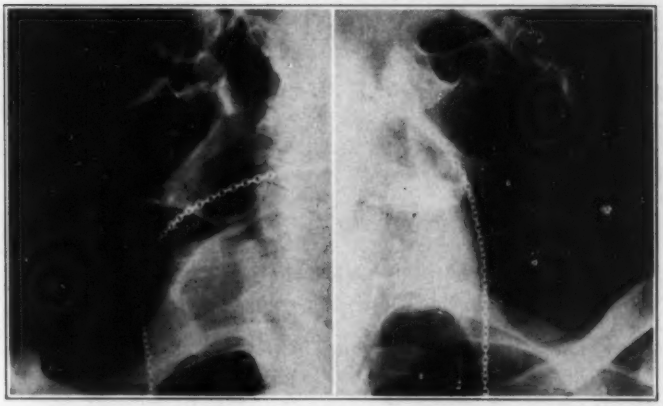

Fig. 2.—Roentgenograms showing reduction of fracture and fixation by direct wiring.

Roentgenographic Examination.—Roentgenograms substantiated the clinical findings by revealing the fracture of the left horizontal ramus of the mandible with upward and medial displacement of the posterior fragment (Fig. 1). There was no evidence of callus formation.

Diagnosis.—Fibrous malunion of fracture of the mandible.

Operation.—Utilizing a local anesthetic, 2 per cent procaine with epinephrine, an incision was made extra-orally along the inferior border of the mandible through the skin and superficial fascia. The external maxillary artery and the posterior facial vein were identified, ligated and sectioned. An incision was then made through the periosteum at the fracture site and the ends of the fragments were exposed.

There was considerable scarring with dense fibrous tissue between the fragments. This tissue was completely removed. The ends of the bone were freshened and placed in proper alinement and the fracture was reduced. With a surgical drill both fragments were perforated 1 cm. from the line of fracture, taking care to avoid the inferior alveolar nerve. The fracture was reduced and immobilized by direct ligation with 24 gage stainless steel wire passed through the small perforation in each fragment (Fig. 2).

Sulfanilamide crystals were dusted into the operative site and the wound was closed in layers. At no time was the oral cavity invaded.

Postoperative Course.—Recovery was uneventful and the wound healed rapidly. There was normal contour and function of the mandible. The skin sutures were removed on the fifth postoperative day. The patient has been checked up by his local physician at the factory where he was injured and reports no complication. The patient is wearing full dentures with normal function.—*Department of Oral Surgery, University Hospital and School of Dentistry, University of Michigan.*

HEMIRESECTION OF THE MANDIBLE FOR OSSIFYING FIBROMA: REPORT OF CASE

JOHN W. KEMPER, M.D., D.D.S., Ann Arbor, Mich.

History.—The patient first noted a slight swelling over the right body of the mandible seven years previous to admission to University Hospital. There was no associated pain or discomfort and for this reason the patient did not consult anyone relative to the swelling for four years. She was referred at that time to a general surgeon who later reported that there was a visible tumefaction of the right body of the mandible. The swelling was hard and round and measured approximately one and one-half inches at its greatest diameter. A biopsy was made and reported as ossifying fibroma. The tumor was exposed intra-orally and removal was attempted by excision and curettage, leaving only the thin lingual plate of the mandible.

After this operation the patient had no unusual reaction. However, it was noted on periodic examinations that the tumor was reappearing and was progressively increasing in size. The patient was then referred to University Hospital for treatment.

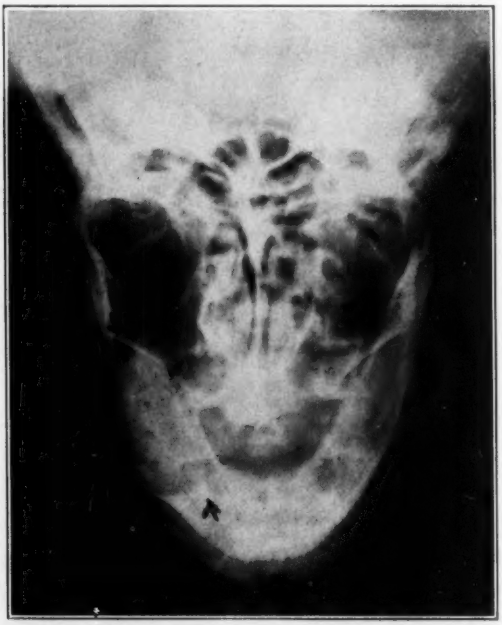

Fig. 1.—Roentgenographic appearance of ossifying fibroma of the mandible.

Fig. 2.—Postoperative roentgenogram showing partial resection of the mandible.

The past history was entirely negative and irrelevant.

Examination.—The patient was a well-developed, rather poorly-nourished white woman, aged 45. There was an obvious deformity of the body of the right mandible, extending from the cuspid region posteriorly to the angle. The tumor was very hard, painless and noninflammatory. Intra-oral examination showed an edentulous mouth. The oral mucosa appeared to be normal. Bimanual examination revealed an oval bulging of the buccal and lingual plates of the mandible on the right side from cuspid to angle, with uniform, symmetrical increase in the width of the body to about twice its normal size. There was no associated adenitis.

The rest of the examination, including blood and urine studies, was entirely negative.

Roentgenographic Examination.—An expansile lesion was revealed, well circumscribed, with no evidence of extension beyond the cortex. The appearance was compatible with ossifying fibroma (Fig. 1).

Operation.—Owing to extensive involvement it was felt that partial resection of the mandible was indicated in order to eradicate the neoplasm.

Anesthesia was induced by the intratracheal administration of nitrous oxide and ether and an incision was made from the midline of the chin along the inferior body of the mandible posteriorly to the angle. The incision was carried through the skin and superficial fascia down to the mandible. The external

maxillary artery and vein were identified, ligated and severed. The periosteum was then elevated throughout the entirety of the body of the mandible up to the crest of the alveolar ridge. With a Gigli saw, the bone was sectioned 1 cm. to the right of the median line. The mylohyoid muscle was then dissected free from the lingual surface. The body was retracted and the attachments of the internal pterygoid and masseter muscles were excised, exposing the ascending ramus up to the mandibular sulcus. Here the inferior dental artery and nerve were identified, tied and severed. With the Gigli saw, the ascending ramus was cut below the sigmoid notch, leaving the coronoid and condyloid processes (Fig. 2). The tissues were then closed in layers and a Penrose drain was inserted.

Postoperative Course.—Except for a slight elevation in temperature and a serous drainage for several days, the patient's recovery was uneventful. After complete healing had occurred, dentures were constructed.

Microscopic Examination.—Microscopic examination substantiated the roentgenographic appearance of ossifying fibroma of the body of the mandible. No malignancy was present.

Final Examination.—A very satisfactory result has been attained. There is very little asymmetry of the face with the exception of a depression anterior to and below the ear. The patient is now wearing full upper and lower dentures which function normally.—*Department of Oral Surgery, University Hospital and School of Dentistry, University of Michigan.*

LOCAL USE OF SULFATHIAZOLE

One can conclude from these results that sulfathiazole used locally in wounds does not prevent wound infection. There are several reasons for this conclusion.

1. The organisms which cause wound infection are not very susceptible to the sulfonamides.

2. Dead tissue and foreign bodies, which are of necessity present to some extent in any wound, inhibit the action of sulfonamides.

3. Sulfathiazole leads to increased bleeding and hematoma formation, a factor known to predispose to infection.

These disadvantages together with their proved inability to prevent wound infection should lead us to seek other means of decreasing the incidence of infection in surgical wounds.—*O'Donnell et al., in Surg., Gynec. & Obst. 82:325, March 1946.*

PREPARATION OF A SCREW LOCK SECTIONAL SPLINT WITH MECHANICAL RETENTION

WILLIAM D. MCCARTHY,* D.D.S., and STANTON R. BURNS,† D.D.S.,
Denver, Colo.

The treatment of complex fractures of the superior maxilla and of the mandible where secure fixation is essential over long periods of time or during bone graft procedure has been simplified by the use of fabricated splints. Their correct application, when used where indicated, in the place of wiring or arch bars, has afforded increased comfort and more adequate feeding of the patient during the trying period of support. Security of fixation is in direct proportion to the type of appliance selected and the skill of the operator in its fabrication and application.

A thorough understanding of the anatomic structures, including the muscle origin, insertion and directional pull, must be achieved for any degree of success in the selection and design of splints which will serve adequately as reduction and fixation appliances. Special consideration must be given to the selection of a type which will approach the basic requisites. It must have secure retention with the least bulk possible, afford the possibility of adding intra-oral and extra-oral extension appliances and insure maximum hygiene and normal occlusion after reduction.

The many types of splints available facilitate the treatment of jaw fractures and many opinions as to their individual advantages and disadvantages are entertained. The choice of the splint in the individual case depends upon the facilities available, the nature of the injury, the time necessary for bone union, either by healing or bone graft, the condition of the remaining teeth and the possibility of obtaining an accurate impression.

Acrylic splints have been used to marked advantage in the treatment of edentulous jaws. These splints lack the necessary strength and rigidity for secure fixation in dentulous cases and present a hygiene problem.

Cap splints in the hands of an operator who is skilled in their fabrication and application have been invaluable aids. By their use, however, the occlusal relationship remains indefinite until after their removal and subsequent extensive spot grinding may be necessary to restore normal function.

The cast sectional splints are useful in cases requiring long fixation and offer many advantages. Their chief shortcomings have been lack of retention, insecurity and difficulty of positive fixation owing to the use of a lock made of a split button wrapped with wire.

The need is recognized for a more efficacious appliance embodying the

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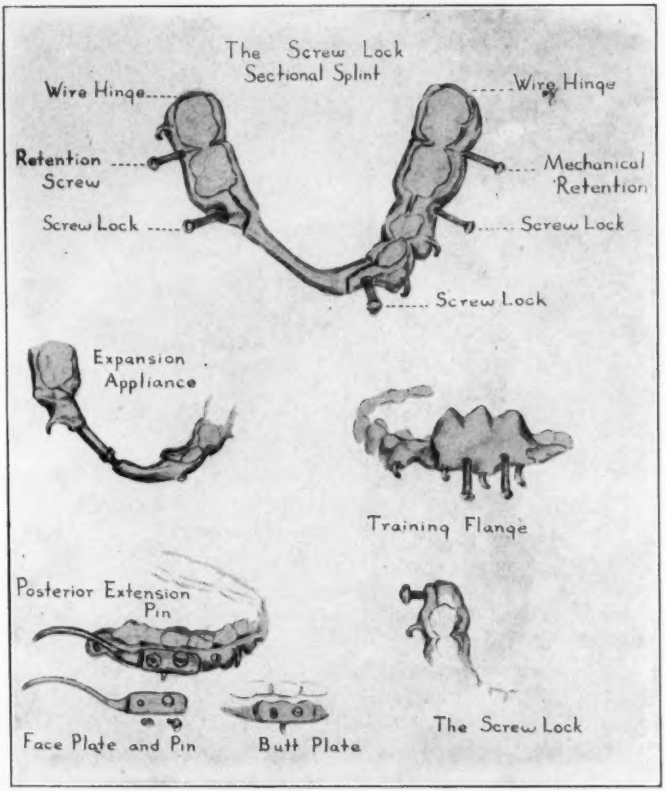

Fig. 1.—Screw lock sectional splint and variations.

virtues of each splint and incorporating improvements to overcome the disadvantages.

The splint which was developed and used at Dibble General Hospital is a screw lock sectional appliance made with a precision lock and mechanical retention (Fig. 1).

The lock is made of 0.80 mm. or 3.48 mm. stainless steel or brass screws which are placed in the splint so as to close and lock the wing segments when seated. The mechanical retention is added by the placing of pointed interproximal retention screws, 0.80 size, which engage the contact points or the tooth undercut. Owing to the positive fixation made possible by the incorporation of screw fixation in the appliance, retention does not depend on cementation although all splints are cemented in place to prevent etching of the teeth.

Since the occlusal surfaces of the teeth are exposed, prompt and reliable reduction of the displaced fragments to their normal relationship is insured at the time the appliance is placed.

The facets of the teeth serve as the most definite guide to the patient's normal occlusion and therefore at the time of fracture reduction they must be carefully checked and any necessary alterations in the appliance must be effected to return the teeth to their original opposing contact. This feature of the sectional open occlusal splint often saves extensive occlusal adjustment later.

The positive retention and secure screw lock fixation allow reduced bulk. Festooning the interproximal surfaces and finishing the gingival portion to a sharp margin eliminate overhangs and assure optimum hygiene.

The splint is made of cast silver alloy or may be made of gold. We have successfully used silver alloy: 87 per cent silver, 10 per cent copper, 2 per cent nickel and 1 per cent zinc. By melting the square bar metal of nickel silver (same formula), supplied by orthodontic appliance firms, into a casting ingot, better castings result than with the prepared alloy.

The high tensile strength of the alloy permits the production of light but strong wing segments, affording four dimensional control as well as the bridging of gaps in the arch without fear of torque.

TECHNIC

The fabrication of a successful splint appliance depends upon proper treatment planning to overcome the difficulties encountered in taking an accurate impression.

The unfavorable conditions encountered may include:

1. Displacement of the parts with accompanying pain.
2. Contracture of the orbicularis oris muscle or cicatrices of the cheeks.
3. Exaggerated mobility of the tongue and an excess of mucin-laden saliva.
4. Gingival hypertrophy resulting from long periods of wiring and poor hygiene.
5. Trismus.

The use of a prefabricated tray designed for the case is necessary in many instances. We have observed that the alginate material has rendered entirely satisfactory results and, when used with a planned tray, allows insertion and removal in cases of diminished vertical opening as well as faithful reproduction of tooth form and undercuts.

Premedication of the patient with morphine sulfate 1/6 grain and atropine sulfate 1/150 grain insures the patient's comfort and cooperation and diminishes the amount of saliva.

Master casts are made of dental stone and the fracture line is reproduced, after plotting, by sawing through the base and separating the fragments.

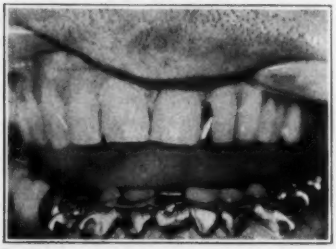

Fig. 2.—Screw lock through a missing tooth area.

Since the only reliable guide to normal position is the maxillary model, the parts are reassembled and waxed together, using the facets of the teeth as guides. A removable index base which is the record of the repositioned cast fragments is poured in stone. The index allows easier handling than a cast fixed together by plaster, although either method may be used. The corrected cast is reproduced in refractory material, using a good agar type duplicating material, under pressure.

It is important to reproduce the interproximal undercuts. In some cases it has been helpful to use cocoa butter on the master cast before making the reproduction impression, thus providing sharper definition of the undercut areas by easy removal of the reproduction material.

The planning and designing of the case must be done carefully, keeping in mind the factors which determine success or failure.

Careful evaluation must be made of the occlusion, the contour of the remaining teeth, the inclination of the teeth, buccally or lingually, and the presence of sufficient retention by the presence and the contour of interproximal undercuts. The mechanical retention screws must be placed in the most favorable areas on the buccal surface where the point will lock under the opposing tooth contacts. The areas where hinges are to be placed and the most favorable area for the precision screw lock must be selected.

Usually, the most anterior area available is the best location for the screw lock. If an anterior tooth is missing, an ideal lock section can be prepared so that the tapped lingual section holds the buccal wing segments firmly when the 0.80 screw is seated (Fig. 2). The screw lock may also be placed through the area of a missing posterior tooth or may be placed behind the posterior tooth, replacing one hinge (Fig. 3, left).

The precision screw lock may be made in many designs to meet the needs of the case. A solid lingual segment and split buccal segments tapped and held with 0.80 or 3.48 screws serve well in the areas of missing teeth.

A solid lingual segment protruding posteriorly to the last tooth and

Fig. 3.—Left: Posterior extension pin appliance. Right: Type of expansion splint.

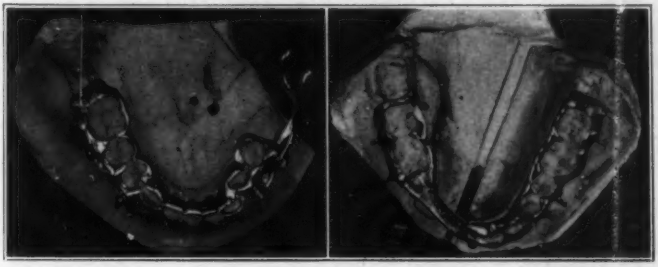

Fig. 4.—Left: Posterior extension pin appliance. Right: Posterior portion of splint is anterior to the last tooth.

matched with the buccal segment, both being held by 0.80 screws, serve when placed around the last tooth (Figs. 3, left and 4, right).

The case is waxed as for an ordinary casting, keeping in mind that for a silver splint the thickness should be somewhat greater than for gold. The buccal and lingual surfaces are covered with a 2 mm. thickness of wax at the highest contour point and tapered to a knife edge at the gingival and occlusal margins.

The hinges are made of 18 gage wrought gold wire contoured to the distal surface of the posterior tooth and placed below the bell of the distal contour, leaving the ends one-quarter inch long so as to be engaged in the casting investment in order to prevent their moving from position during casting.

Considerable time and difficulty may be saved by preparation of the sectional lock and the screw holes during the waxing procedure, thus preventing the necessity of extensive drilling and sawing of the metal casting.

The areas where the sectional segments are to separate are prepared by the insertion of either a steel separating disc or sheet mica which has been drilled with a hole, using a size 37 drill, in the area of the planned

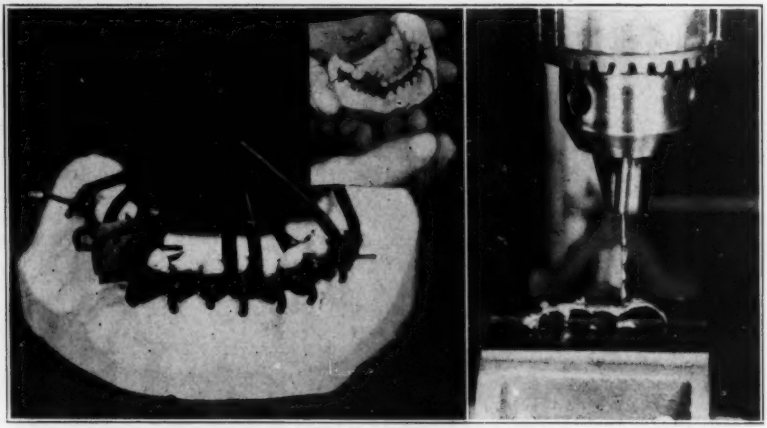

Fig. 5.—Inset: Wax pattern showing hinges and discs in precision lock with carbons and intermaxillary hooks. Left: Wax pattern sprued with reservoirs. Right: Drilling the screw holes.

screw lock. The steel disc disintegrates during burnout and allows the sections to separate, eliminating the arduous task of sawing. The sheet mica also gives an excellent result.

All areas where screw holes are to be placed, either in the precision screw lock or in the areas of planned mechanical retention, are prepared by the insertion of 18 gage carbon points into the wax in the exact position of the desired holes. This facilitates the drilling of the splint at points where screws are to be placed.

After the parts of the precision screw lock and the individual mechanical retention screw carbons are placed, the festooning is done. Intermaxillary hooks are placed with 18 gage round wax in the areas of the splint where traction is desired in order to leave the carbon point areas free and to keep the hooks at the interproximal spaces. The hooks are contoured and curved close to the splint to prevent abrasion of the buccal mucosa (Fig. 5, inset).

In order to minimize the difficulties in the casting of silver, careful placing of one-third larger sprues with gas reservoirs attached is recommended (Fig. 5, left).

The case is invested and cast, using a three-hour burnout at 1340° F. for the silver alloy. Gold cases are cast at 1150° F.

After pickling, the splint is given a preliminary finishing and polishing, care being taken to finish the gingival and occlusal margins to a sharp edge.

The screw lock holes and the interproximal retention holes prepared by the carbon points are drilled with a size 37 drill. Each hole is then

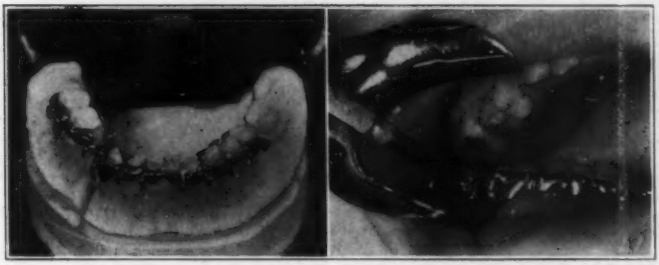

Fig. 6.—Left: The interproximal screw ground to a point. Right: The precision screw lock.

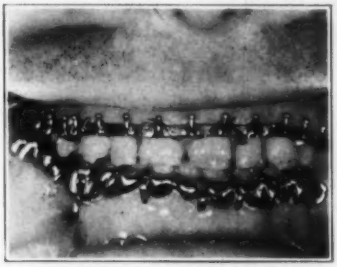

Fig. 7.—The screw lock sectional splint in place on lower teeth.

tapped with an 0.80 tap for reception of an 0.80 stainless steel or brass screw (Fig. 5, right).

After tapping, the sections separate easily through the line of the oxidized steel disc or imbedded sheet mica strip, producing the sectional wings which may be locked with the prepared precision screw lock.

The case is then placed on the articulated master cast and checked for occlusion and retention. Each interproximal retention screw is adjusted and ground to a point so that it will lock under the interproximal contacts for added retention (Fig. 6, left). After final finishing and polishing the appliance is ready for use.

The fracture is reduced and the splint is placed (Figs. 6 and 7), under conduction anesthesia, usually a third division block. One hour before reduction, the patient is given premedication consisting of morphine sulfate ¼ grain and atropine sulfate 1/150 grain.

All splints are cemented in place, using a retarded mix of cement to allow six to ten minutes working time.

We have found the silver alloy adequate for use with the screw lock and have had little difficulty with stripping of the screw threads. When adding screws through a small bulk of metal, however, reinforcing plates of gold are incorporated in the splint.

Fig. 8.—Left: Posterior extension pin to screw lock splint. Right: Posterior extension pin to screw lock splint.

Fig. 9.—Left: Training flange splint. Right: Extra-oral arm to headcap and intra-oral arm to crown on third molar.

The use of 3.48 screws permits the addition of intra-oral extension arms, stent appliances, removable training flanges and extra-oral arms to engage a head cap or permit traction.

Any of the various extensions may be applied by incorporating a butt plate made of a gold casting ingot in the splint before casting, or afterwards, by soldering. It is preferable to plan the attachments when making the splint, thus saving the soldering operation which will render the silver alloy more ductile.

The intra-oral posterior extension pin may be added to the appliance by planning a butt plate with one 0.80 threaded stud attached to the splint and a face plate attached to the pin. After preparation of one screw hole as for the screw lock, the face plate may be placed with one 0.80 screw and one 0.80 nut, using the stud screw for a fulcrum to place the pin. Size 3.48 screws may be used where possible and in some instances double studs and nuts may be used (Figs. 3, 4 and 8).

Stent appliances may be attached by the addition of 3.48 screws tapped into the splint.

The training flange is a useful addition to the splint for obtaining normal relation. It may be cast to the splint or added later, where indicated, by 3.48 screws, thus making it removable (Fig. 9, left).

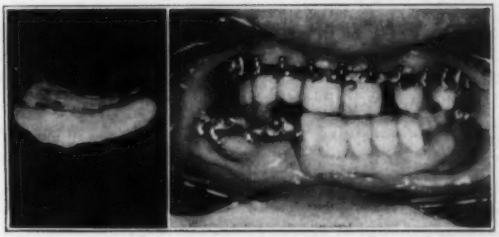

Fig. 10.—Left: Acrylic clip-on prosthesis. Right: Acrylic clip-on prosthesis in place.

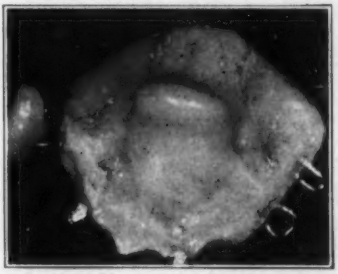

Fig. 11.—Obturator appliance which fastens to splint.

Extra-oral arms may be attached to the face plate and butt plate with 3.48 screws (Fig. 9, right).

If the anterior teeth are absent and atrophy of the orbicularis oris muscle and distortion of the facial symmetry are likely to result, an esthetic acrylic clip-on prosthesis is prepared to supply the anterior teeth. The prosthesis is made with gold clasp wire contoured to the splint bar to give retention. It provides contour and esthetics and insures hygiene since it is removable (Fig. 10).

In cases of fractures and loss of portions of the superior maxilla where large antra-oral or stomatonasal fistulae are present, the clip-on principle has been used to make a removable obturator which provides comfort to the patient during the fixation period (Fig. 11).

SUMMARY

The development of the screw lock has eliminated the arduous task of using wire loops to retain a splint. The mechanical retention made available by the proper placing of pointed interproximal retention screws has insured a secure appliance. When both are combined with the sectional open occlusal principle, an excellent appliance is available which allows checking of the relationship by inspection of the facets of the teeth during fixation and repair of the fracture.

The use of the screw lock sectional splint in place of wiring or arch bars insures four dimensional control of the fragments. Use of the screw lock and interproximal retention has made possible greater retention per unit bulk and permits the bridging of large gaps in the arch because of the high tensile strength of the alloy and secure fixation of the appliance.

The success of fracture treatment depends largely on secure fixation and immobilization of the fragments together with the retaining of the patient's remaining teeth in as near a normal relationship as possible.

The selection of an appliance to be used in the individual case depends on the conditions present, the facilities available and the conviction of the operator that he can render maximum comfort to the patient with assurance that further operative procedures will not result from inadequate or faulty fixation.—*512 Republic Building.*

ADENOCARCINOMA OF PAROTID GLAND

1. Ten per cent of a series of consecutive primary parotid neoplasms appeared to be adenocarcinomas of the type cylindroma, so classified because of a distinctive microscopic pattern.

2. This group of 21 cases was characterized clinically by the presence of sharp radiating pain and local fixation of tumor in 40 per cent, features unusual in connection with other primary neoplasms of this location. Partial or complete paralysis of the facial nerve was also a contrastingly common finding.

3. Surgically, the tumors were generally more infiltrative than encapsulated and application of the principle of "wide local excision" prevented recurrences in 5 of 21 cases.

4. Pathologically, the appearance of darkstaining epithelial islands and strands with central honeycombing in a hyaline stroma was diagnostic. Epithelial mucus was sometimes present. Infiltrative tendencies were pronounced, with a special predilection for invasion of nerve sheaths.

5. Eight of the 20 traced patients succumbed within 5 years to the effects of metastasis, 5 with evidence of pulmonary spread. Two died more than 5 years after operation. Four of the remaining 10 are suffering from inoperable (?) recurrences.

6. Solid tumors of the parotid gland should be assumed to be malignant until proved otherwise.

7. It is suggested that more radical surgical procedures will have to be done in order to obtain better results in the treatment of this form of neoplasm.—*Quattlebaum, in Surg., Gynec. & Obst. 82:347, March 1946.*

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